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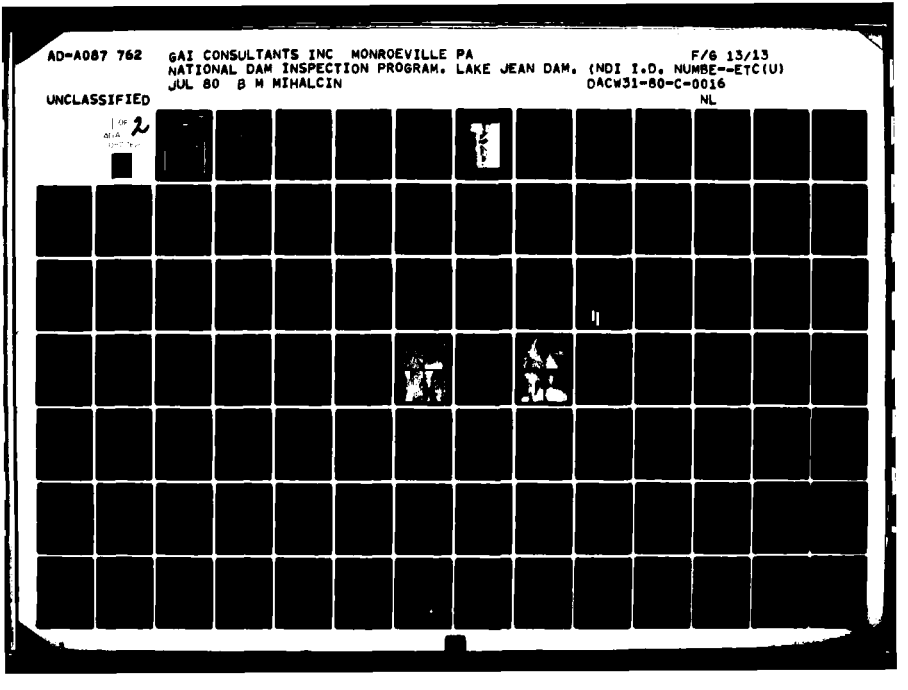

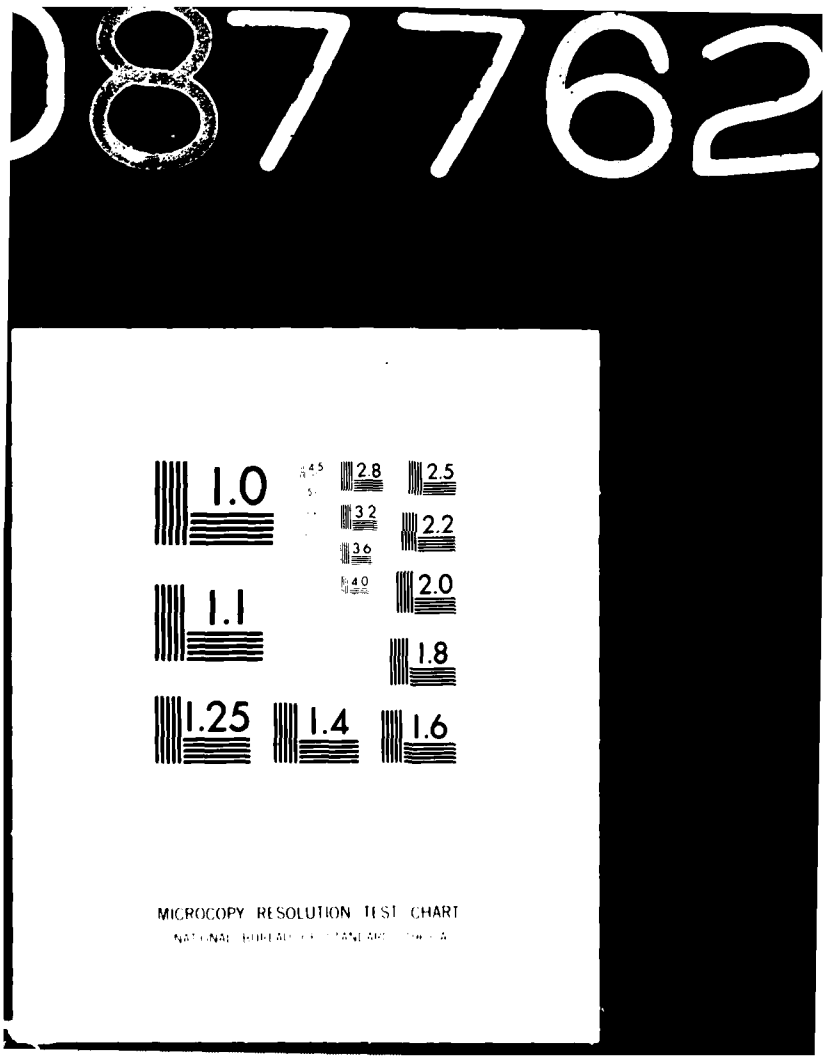
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MICROCOPY RESOLUTION TEST CHART

LEVEL II

SUSQUEHANNA RIVER BASIN
BRANCH OF KITCHEN CREEK, LUZERNE COUNTY
(10) Bernard M. Mihalcin

National Dam Inspection Program
LAKE JEAN DAM

(NDI I.D. [redacted] PA-00570 Number)
PENNDER I.D. [redacted] 40-16)
Susquehanna River Basin
Branch of Kitchen Creeks
Luzerne County, Pennsylvania
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AD A087762

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topograhic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Lake Jean Dam: NDI I.D. No. PA-00570

Owner:	Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER)
State Located:	Pennsylvania
County Located:	Luzerne
Stream:	Branch of Kitchen Creek
Inspection Date:	25 April 1980
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

The visual inspection, operational history, and hydrologic/hydraulic analysis indicate that the facility is in good condition.

The facility consists of a main dam (Lake Jean Dam) and two appurtenant saddle dams (east and west dikes). The size classification of the facility is intermediate and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility is the PMF (Probable Maximum Flood). Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store about 73 percent of the PMF prior to overtopping the east dike. Thus, based on the screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate. Should the saddle dams be regraded to their design elevation, the spillway would then pass floods in excess of the PMF and would be considered adequate.

Deficiencies noted by the inspection team included; 1) a poorly drained, marshy area below the left downstream toe of Lake Jean Dam; 2) embankment crests below design elevation associated with the east and west dikes; 3) lack of provisions for the regular maintenance of the east and west dikes and the inclusion of neither structure in the formal emer-

gency warning system prepared for Lake Jean Dam.

It is recommended that the owner immediately:

a. Drain the marshy area below the left downstream toe of Lake Jean Dam. Upon successful completion of this task, the location and extent of seepage (if any) at the embankment-left abutment contact should be visually assessed and subsequently monitored on a regular basis, noting any turbidity and/or changes in rate of flow.

b. Survey and regrade the crests of both the east and west dikes and restore them to their original design elevations.

c. Develop formal manuals of operation and maintenance to ensure the continued proper care of the facility. Included in these manuals should be provisions for the regular scheduled maintenance of the east and west dikes.

d. Revise the present formal warning system to include both dikes and their respective downstream reaches.

GAI Consultants, Inc.

Bernard M. Mihalcin

Bernard M. Mihalcin, P.E.

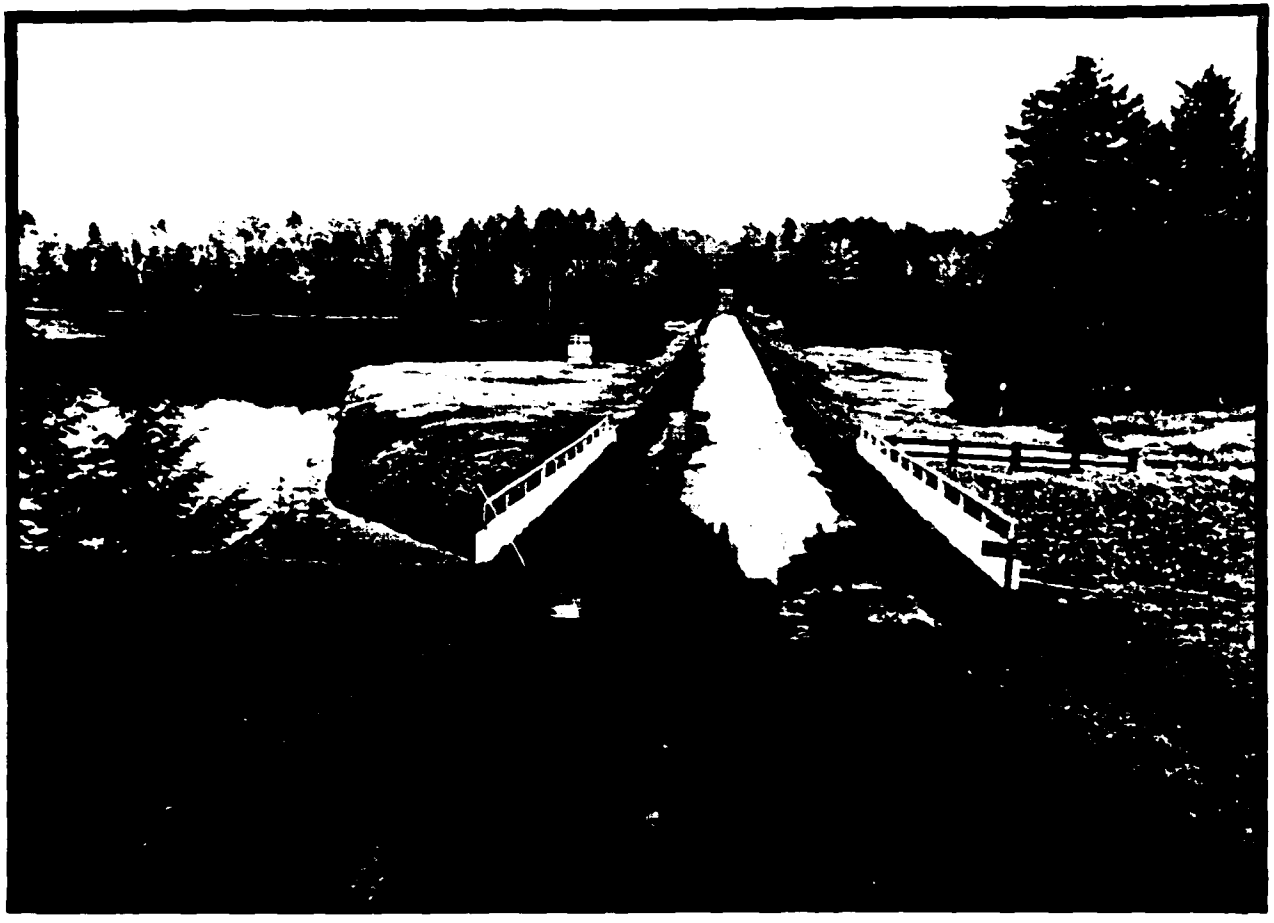
Date 10 July 1980

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 31 JUL 1980

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
BERNARD M. MIHALCIN
ENGINEER
20371-E



OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE JEAN DAM
NDI# PA-00570, PENNDER# 40-16

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Jean Dam is a zoned earth embankment approximately 26 feet high and 780 long, including spillway. The emergency spillway is an uncontrolled, rectangular, concrete and rock cut chute channel located at the right abutment. The crest of the spillway is 20 feet long and is spanned by a concrete bridge which supports a portion of the bituminous roadway that covers the embankment crest. Drawdown capability is provided by means of a 30-inch diameter cast iron blowoff pipe controlled at the inlet by a 30-inch diameter sluice gate. The sluice gate control mechanism is situated atop a concrete control tower located along the upstream embankment slope about 400 feet from the right abutment.

Lake Jean Dam is the largest of three embankments which impound the waters of Lake Jean. The two smaller earth and rockfill dams, located at opposite ends of the lake (see Figure 1), are referred to as the east and west dikes, respectively, in Figure 2.

b. Location. Lake Jean Dam is located on a branch of Kitchen Creek in Fairmont Township, Luzerne County, Pennsylvania. The facility is contained within Ricketts Glen State Park, near Pennsylvania Routes 118 and 487, about four miles north of Red Rock, Pennsylvania. A natural lake named Ganoga Lake is situated less than two miles upstream on a tributary to the northwest of Lake Jean. The dam, reservoir,

and watershed are contained within the Red Rock, Pennsylvania, U.S.G.S. 7.5 minute topographic quadrangle (see Figure 1, Appendix E). The coordinates of the dam are N41° 21.1' and W76° 18.0'.

c. Size Classification. Intermediate (26 feet high, 3990 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Commonwealth of Pennsylvania
Office of Resources Management
Department of Environmental Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17120

f. Purpose. Recreation.

g. Historical Data. Lake Jean Dam was constructed for the State of Pennsylvania in 1949-1950 as a recreational facility for Ricketts Glen State Park. The facility was designed by Knappen, Tippetts, Abbett Engineering Company of New York, New York and was constructed by the Marshall Construction Company of Harrisburg, Pennsylvania. No major modifications have been made to the facility subsequent to its completion.

1.3 Pertinent Data.

a. Drainage Area (square miles). 3.0

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Discharge curves are not available.

Discharge Capacity of Spillway at Maximum Pool ≈ 1420 cfs (see Appendix D, Sheet 10).

c. Elevation (feet above mean sea level). The following elevations were obtained from available drawings and through field measurements that were based on the elevation of the emergency spillway crest at 2220.0 feet (see Appendix D, Sheet 1).

Top of Dam	2229.0 (design). 2228.9 (field).
Top of West Dike	2229.0 (design). 2228.0 (field).
Top of East Dike	2229.0 (design). 2227.0 (field).

Maximum Design Pool	Not known.
Maximum Pool of Record	2222.4 (June, 1972).
Normal Pool	2220.0
Spillway Crest	2220.0
Upstream Inlet Invert	2204.0
Downstream Outlet Invert	2203.1
Streambed at Dam Centerline	2204 (estimate).
Maximum Tailwater	Not known.

d. Reservoir Length (feet).

Top of Dam	10700
Normal Pool	10500

e. Storage (acre-feet).

Top of Dam	3990
Normal Pool	1400
Design Surcharge	Not known.

f. Reservoir Surface (acres).

Top of Dam	337
Normal Pool	245
Maximum Design Pool	Not known.

g. Dam.

Type	Zoned earth and rockfill.
Length	760 feet (excluding spillway).
Height	26 feet (field measured; outlet invert to embankment crest).
Top Width	30 feet (design). 26 feet (field).
Upstream Slope	1.75H:1V
Downstream Slope	1.75H:1V
Zoning	Rolled earth core flanked by thin gravel filters and outer shells con-

		sisting of rockfill (see Figure 5).
	Impervious Core	Figure 5 indicates embankment has a central core section comprised of rolled earth. A trapezoidal shaped cutoff trench and small concrete cutoff wall are also shown. Materials specifications are not available.
	Grout Curtain	Drawings (see Figure 4) indicate grout curtain along centerline of dam. No details or grouting records are available.
h.	Diversion Canal and Regulating Tunnels.	None.
i.	Spillway.	
	Type	Uncontrolled, rectangular, concrete and rock cut chute channel located at the right abutment.
	Crest Elevation	2220.0 feet.
	Crest Length	20 feet.
j.	Outlet Conduit.	
	Type	30-inch diameter C.I.P. encased by concrete in trench cut into rock.
	Length	145 feet.
	Closure and Regulating Facilities	Control is provided

	via 30-inch diameter sluice gate at the inlet. Operation is from atop the concrete control tower.
Access	Control tower is accessible by boat at normal pool level.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No design data, calculations, or formal design reports are available. Limited data pertaining to the design features of Lake Jean Dam are contained within PennDER files in the form of design drawings, construction cost estimates, state inspection reports, dated photographs, and miscellaneous correspondence. An engineer's report is referenced but not contained in PennDER files.

b. Design Features.

1. Embankment. Information contained in PennDER files indicates the embankment is a combination earth and rockfill structure. Pertinent embankment details are presented in Figures 4 and 5. The main embankment section consists of a rolled earth core 10 feet wide at the top with 1H:1V side slopes. The earth core is flanked, both upstream and downstream, by 18-inch thick gravel filters that are, in turn, covered with rockfill which comprises the embankment outer shells. A trapezoidal shaped cutoff trench is provided along the embankment centerline. The trench is 16 feet wide at the base and has 1H:1V side slopes. A small concrete cutoff wall is constructed along the centerline of a portion of the cutoff trench approximately between Stations 4+00 and 6+70 The cutoff wall is 1.5 feet wide at the top, 5 feet high, and extends 3 feet into rock. A grout curtain along the embankment centerline, with limits to have been field determined, is also indicated. The embankment crest is topped by a bituminous roadway to protect it from heavy vehicular use.

2. Appurtenant Structures.

a) Spillway. The spillway is an uncontrolled, rectangular, concrete and rock cut chute channel located at the right abutment. There are three distinct portions of the spillway; 1) a trapezoidal shaped approach channel approximately 380 feet long which is partially cut in rock; 2) a concrete control section about 30 feet in length with a 20-foot long crest; and 3) a 600-foot long trapezoidal shaped discharge channel cut into rock. The concrete control section is spanned by a concrete bridge structure which limits the size of the opening at the crest and effectively creates an orifice flow condition at pool levels greater

than 8 feet above normal pool (see Figures 4 and 7).

b) Outlet Conduit. The outlet conduit consists of a 30-inch diameter cast iron pipe encased in concrete and controlled by a 30-inch diameter sluice gate at the inlet. The gate is housed at the base of a concrete control tower located on the upstream embankment slope and is operated from atop the tower deck. The conduit discharges at the downstream embankment toe where it empties into a concrete outlet structure and rock lined trapezoidal shaped discharge channel. The original design provided for discharging low flows by means of an 8-inch diameter gate valve located several feet above the sluice gate and operated independently from atop the concrete control tower (see Figures 4, 5 and 6). This valve was reportedly plugged in 1968 and is no longer functional.

c) East and West Dikes. Two small saddle dams have been provided, by design, across low areas both east and west of the main embankment. The west dike appears similar to the cross-section shown in Figure 2; whereas, the east dike has apparently been modified and is somewhat more massive than the section depicted.

c. Specific Design Data and Criteria. No formal design reports, calculations or specific design data are available for any aspect of this facility.

2.2 Construction Records.

The majority of information contained in PennDER files was compiled during the construction period. Included are construction invoices, semi-monthly progress reports and miscellaneous correspondence. No construction photographs are available.

2.3 Operational Records.

No records of the day-to-day operation of the facility are maintained.

2.4 Other Investigations.

The facility is formally inspected on an annual basis by state representatives of the PennDER, Division of Completed Projects. Results of past inspections, including photographs, are available from PennDER. The marshy condition at the left downstream toe of the dam was assessed by

the Bureau of Engineers in 1971-72 and recommendations to install granular drains were submitted. To date the recommendations have not been implemented. Apart from annual inspections, no other formal investigations have been performed.

2.5 Evaluation.

The information available is considered adequate to make a reasonable Phase I assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the facility suggests the dam and its appurtenances are in good condition.

b. Embankment. The visual inspection indicates the embankment is well maintained and in good condition. No evidence of sloughing, erosion, animal burrows, excess settlements, seepage through the embankment face, or signs of maintenance neglect were observed (see Photographs 1 and 2). A large saturated area was observed immediately beyond the downstream embankment toe adjacent the left abutment (see Photograph 4). A small quick condition was encountered at the left abutment-embankment contact about 16 feet below the top of the dam. This marshy area was originally referenced in a state inspection report dated April 15, 1969 and has apparently remained fairly stable over the last decade.

c. Appurtenant Structures.

1. Spillway. The spillway is considered to be in excellent condition (see Photographs 5 and 6). One minor crack in the downstream training wall was the only evidence of exterior deterioration observed.

2. Outlet Conduit. The outlet conduit is reportedly functional and considered to be in good condition. No evidence of surface deterioration of the concrete control tower or excessive corrosion of the operating mechanism was observed (see Photograph 3).

3. East and West Dikes. The two saddle dams associated with Lake Jean Dam are considered to be in fair condition. Tree growth along the downstream toe of each embankment indicates inadequate maintenance of these facilities. Field measurements indicate the west dike (see Photograph 7) is about 1-foot below its design top of embankment elevation (2229.0) while the east dike (see Photograph 8) is approximately 2 feet low. The design top of embankment elevation is common for both dikes and the main embankment.

d. Reservoir Area. The general area surrounding the reservoir is characterized by gentle to moderate slopes that are heavily forested. No signs of slope distress were observed.

e. Downstream Channel. Discharge from Lake Jean Dam flows for several thousand feet through a relatively flat and broad valley. The area is the former site of Lake Rose whose dam was breached in the early 1970's. At a distance less than 1-mile downstream of the embankment, the stream flows into Ganoga Glen, a steep, narrow valley with steep confining slopes. About 1-mile into the glen, the stream merges with Kitchen Creek which flows almost due south. Between five and seven miles downstream of the embankment five homes are located sufficiently near the stream that they could be affected by an embankment breach. It is estimated that between 10 and 20 persons inhabit these five homes and that more than a few lives could be lost from large discharges associated with a failure of the dam. Consequently, the hazard classification of the facility is considered to be high.

The hazard classification must also consider, in the case of Lake Jean Dam, the potential hazard in the areas downstream of the east and west dikes. The east dike shares a common downstream channel with the main dam, once it merges with Kitchen Creek, at a distance of about 2 miles below the dike. The west dike, however, would discharge into Big Run, if breached. Big Run flows through a steep, narrow valley and through the outskirts of the populated communities of Central and Jamison City, Pennsylvania. As a result, it is apparent that a sudden breach of either dike, independent of a breach of Lake Jean, could result in extensive property damage and possibly loss of life.

3.2 Evaluation.

The overall appearance of the facility suggests it to be in good condition. For the most part the facility and its appurtenances are well maintained; however, it is apparent that the east and west dikes are not as well maintained as Lake Jean Dam. Since all three structures present a potential threat to the downstream populace, it is believed that care for each should be equally established. Specific deficiencies noted by the inspection team include a large saturated area immediately below the downstream main embankment toe adjacent the left abutment, and the excessively low top of embankment elevations of both dikes. Both conditions require corrective action.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

Lake Jean Dam is essentially a self-regulating facility. Excess inflow is automatically discharged through the uncontrolled spillway. The outlet conduit is operated by park personnel bi-annually or as-needed. No formal operating manuals are associated with the facility.

4.2 Maintenance of Dam.

The facility is well maintained, but, on an unscheduled basis. Most major maintenance is performed either just prior to or immediately after the summer park season. No formal maintenance manual is available.

4.3 Maintenance of Operating Facilities.

See Section 4.2 above.

4.4 Warning System.

A formal written plan entitled "Emergency Operation and Warning System, Lake Jean Dam" has been recently developed by the state and is available from the PennDER and at the park office. The plan makes no provisions for the emergency observation of either the east or west dike nor does it provide for warning downstream residents below the dikes in case emergency conditions develop at either location.

4.5 Evaluation.

Lake Jean Dam has a history of adequate maintenance and operation. Formal manuals of operation and maintenance are, nevertheless, recommended to ensure the continued proper care and operation of the facility. Included in these manuals should be provisions for the regular maintenance of the east and west dikes. In addition, the present warning system should be revised to include both dikes and their respective downstream reaches.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design reports, calculations, or design data are available for any aspect of this facility.

5.2 Experience Data.

Information obtained from the park superintendent indicate that the largest recorded floods at Lake Jean Dam occured in June 1972 and October 1975 when pool levels were 2.4 and 1.6 feet above the spillway crest, respectively. The facility reportedly functioned adequately during the events and no significant damage was sustained.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate the spillway could not function satisfactorily during a flood event, within the limits of its design capacity. Field measurements indicated that the crests of the east and west dikes were below design elevation by about two and one foot, respectively, thus reducing the freeboard available for the main dam spillway.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, for Phase I Hydrologic and Hydraulic Evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U.S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Lake Jean Dam is

the PMF (Probable Maximum Flood). This classification is based on the relative size of the dam (intermediate), and the potential hazard of dam failure to downstream developments (high).

b. Results of Analysis. Lake Jean Dam was evaluated under near normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of 2220.0 feet, with the spillway weir discharging freely. The outlet conduit was assumed to be non-functional for the purpose of analysis, since the flow capacity of the conduit is not such that it would significantly increase the total discharge capabilities of the facility. The spillway consists of a rectangular, concrete and rock cut chute channel with discharges controlled by a broad-crested weir. Also included as part of the analysis were the storage effects of upstream Ganoga Lake. All pertinent engineering calculations relative to the evaluation of this facility are provided in Appendix D.

The facility was first analyzed under existing conditions; that is, with the west and east dikes at elevations 2228.0 and 2227.0, respectively, or 1 to 2 feet below the design elevation of 2229.0. Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the facility can accommodate only about 73 percent of the PMF (the SDF) prior to overtopping the east dike. Under PMF conditions, though, neither the west dike nor the main embankment is subject to overtopping. The peak PMF inflow of about 7000 cfs was substantially attenuated by the discharge/storage capabilities of the dam and reservoir, such that the resulting PMF peak outflow was about 2740 cfs. Under the PMF, the east dike was overtopped for approximately 7.3 hours, with a maximum depth of inundation equal to about 0.9 feet (see Appendix D, Summary Input/Output Sheets, Sheets F).

The facility was also analyzed under the assumption that the east and west dikes were brought up to design elevation, or approximately to the level of the main embankment. This analysis indicated that the facility can accommodate storms in excess of the PMF without overtopping of the main embankment or either of the two dikes. The peak PMF inflow of about 7000 cfs was greatly attenuated by the discharge/storage capabilities of the dam and reservoir, such that the peak PMF outflow was only about 1370 cfs (Summary Input/Output Sheets, Sheet I).

5.6 Spillway Adequacy.

Although Lake Jean Dam cannot accommodate its SDF(the PMF) without overtopping of the east dike, the possible downstream consequences resulting from the failure of the dike were not evaluated. Since the facility can safely pass a flood of at least 1/2 PMF magnitude, breaching analysis was not performed, in accordance with Corps directive ETL-1110-2-234. Thus, as Lake Jean Dam cannot safely accommodate a PMF-size flood, its spillway is considered to be inadequate, but not seriously inadequate. However, should the east and west dikes be regraded to design elevation, the facility would be capable of safely accommodating the SDF, and therefore, its spillway would be considered adequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appears to be in good condition. The only significant deficiency noted by the inspection team concerned the large saturated area along the left downstream embankment toe. The condition was originally reported by state inspectors in 1969. The water collects in an area to the right (looking upstream) of the spoil dump shown in Figure 4. Provisions for drainage of the area have apparently been clogged by siltation. It is difficult to assess the actual origin of the collected water although it appears likely to be a combination of direct runoff from the adjoining hillside and seepage associated with the embankment or its foundation. Consequently, the area should be drained immediately and any seepage monitored regularly and assessed.

b. Appurtenant Structures.

1. Spillway. The spillway is considered to be in excellent condition. No significant concrete deterioration was observed.

2. Outlet Conduit. The outlet conduit is considered to be in good condition. Although not operated in the presence of the inspection team, the mechanism is reportedly opened twice yearly.

3. East and West Dikes. Visual observations indicate the east and west dikes are in fair condition. Excessive tree and brush growth along the downstream toe of each structure should be cut back and provisions made for the inclusion of both structures in a regular schedule of routine maintenance. In addition, field measurements indicate each structure to be below design crest elevation, thus reducing the freeboard available for the main dam spillway. Both structures should be regraded to design crest elevation.

6.2 Design and Construction Techniques.

Aside from design drawings, no information is available pertaining to the actual design of the facility.

Information contained in PennDER files relative to construction reveals nothing that would create suspicion as to the integrity of the applied construction techniques.

6.3 Past Performance.

According to available correspondence and discussions with representatives of the owner, the facility has performed satisfactorily since its completion in 1950.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. As the facility appears well constructed and sufficiently stable, it is believed that it can withstand the expected dynamic forces; however, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection suggests the facility is in good condition.

The size classification of the facility is intermediate and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility is the PMF (Probable Maximum Flood). Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store about 73 percent of the PMF prior to overtopping the east dike. Thus, based on the screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate. Should the saddle dams be regraded to their design elevation, the spillway would then pass floods in excess of the PMF and would be considered adequate.

Deficiencies noted by the inspection team included; 1) a poorly drained, marshy area below the left downstream toe of Lake Jean Dam; 2) embankment crests below design elevation associated with the east and west dikes; 3) lack of provisions for the regular maintenance of the east and west dikes and the inclusion of neither structure in the formal emergency warning system prepared for Lake Jean Dam.

b. Adequacy of Information. The available data are considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The recommendations listed below should be implemented immediately.

d. Necessity for Additional Investigations. No additional investigations are deemed necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner immediately:

a. Drain the marshy area below the left downstream toe of Lake Jean Dam. Upon successful completion of this task, the location and extent of seepage (if any) at the

embankment-left abutment contact should be visually assessed and subsequently monitored on a regular basis, noting any turbidity and/or changes in rate of flow.

b. Survey and regrade the crests of both the east and west dikes and restore them to their original design elevations.

c. Develop formal manuals of operation and maintenance to ensure the continued proper care of the facility. Included in these manuals should be provisions for the regular scheduled maintenance of the east and west dikes.

d. Revise the present formal warning system to include both dikes and their respective downstream reaches.

APPENDIX A

VISUAL INSPECTION CHECKLIST AND FIELD SKETCH

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Lake Jean Dam STATE Pennsylvania COUNTY Luzerne

NDI # PA — 00570 PENNDER # 40-16

TYPE OF DAM Earth-Rockfill SIZE Intermediate HAZARD CATEGORY High

DATE(S) INSPECTION 25 April 1980 WEATHER Overcast & Foggy TEMPERATURE 55° @ 9:00 am

POOL ELEVATION AT TIME OF INSPECTION 2220.1 M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
B. M. Mihalcin	Jack Hugendubler	
D. L. Bonk	Brent Semmel	
D. J. Spaeder		

RECORDED BY B. M. Mihalcin

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00570
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed. Both faces are rock covered.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good (main dam, east and west dikes). Vertical - good (main dam). East dike field measured 2 feet low. West dike field measured 1-foot low.
RIPRAP FAILURES	None observed. Riprap is well-graded durable sandstone.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition. Left abutment has evidence of seepage at contact approximately 16 feet from crest.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA. 00570
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Marshy area immediately downstream of toe along left abutment. Poorly drained. Should install drainage trenches and monitor seepage.
ANY NOTICEABLE SEEPAGE	Seepage evident along left abutment - embankment contact. Less than 1 gpm apparent. Small quick condition (≈ 5' ϕ) exists at immediate toe.
STAFF GAGE AND RECORDER	None.
DRAINS	Drains exit in outlet structure. Left side drain discharging (approximately 3-5 gpm total).

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA · 00570
INTAKE STRUCTURE	Concrete tower with intake submerged. Visible portion of tower in good condition. Metal operating mechanisms painted and in good condition.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	30-inch diameter cast iron pipe. Discharge end encased by outlet structure.
OUTLET STRUCTURE	Concrete structure with metal railing. No cracking evident. Excellent condition.
OUTLET CHANNEL	Trapezoidal shaped ditch. Rock lined for ≈ 15'-20' beyond outlet structure. Excellent condition.
GATE(S) AND OPERATIONAL EQUIPMENT	Two gate stems visible on intake structure. Tower not accessible by foot. Operating mechanisms painted and appear to be in good condition.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00570
TYPE AND CONDITION	Uncontrolled, retangular, concrete and rock cut chute channel located at the right abutment. Excellent condition. One minor crack evident in downstream training wall.
APPROACH CHANNEL	Rock lined and partial rock cut. Good condition. Right approach channel wall is rock cut. Left approach channel wall is hand-placed rock for ≈ 30'.
SPILLWAY CHANNEL AND SIDEWALLS	Excellent condition. No cracking evident.
STILLING BASIN PLUNGE POOL	N/A.
DISCHARGE CHANNEL	Trapezoidal shaped channel cut into rock. Excellent condition.
BRIDGE AND PIERS EMERGENCY GATES	Concrete access bridge spans spillway structure. Excellent condition.

SERVICE SPILLWAY

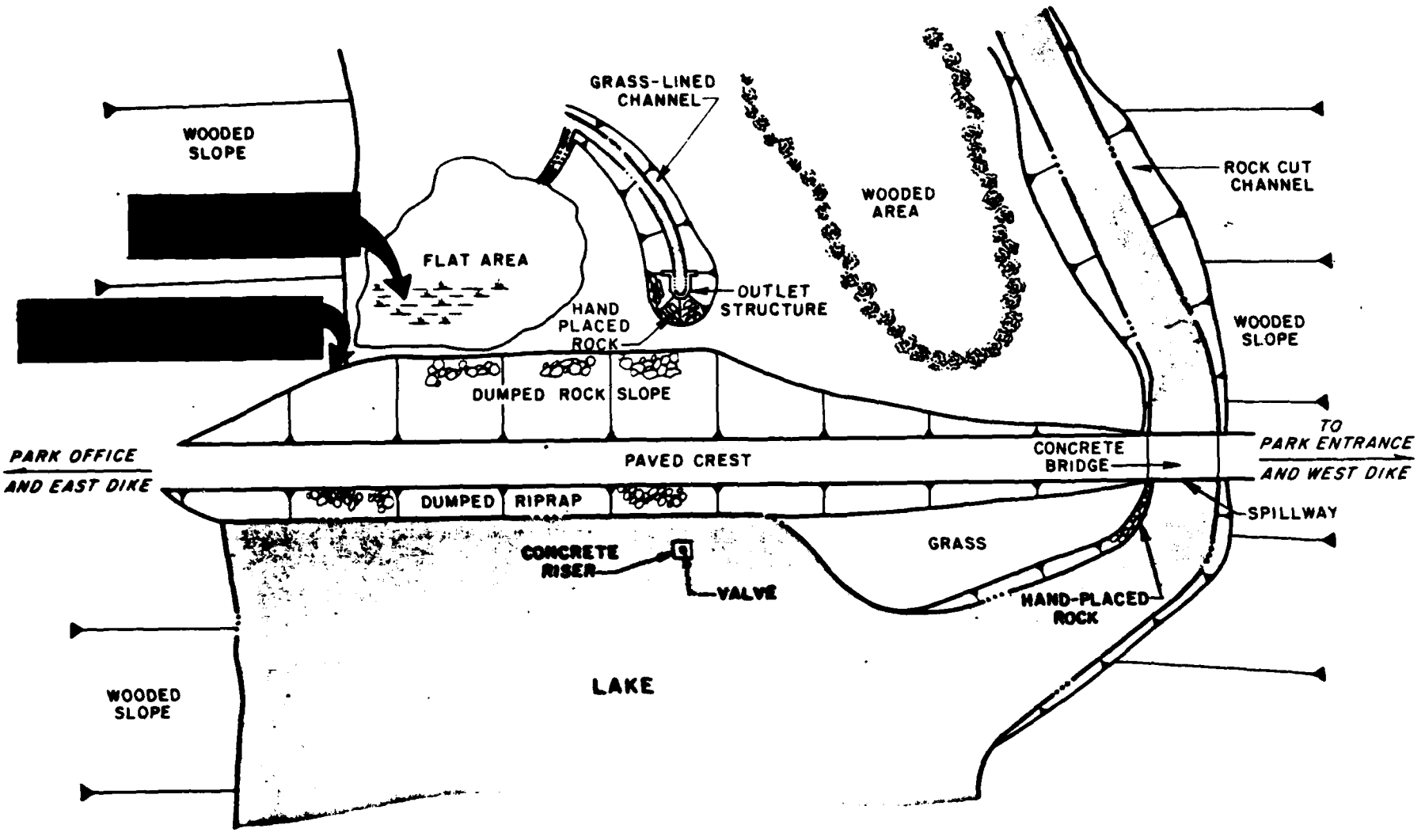
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00570
TYPE AND CONDITION	N/A.
APPROACH CHANNEL	N/A.
OUTLET STRUCTURE	N/A.
DISCHARGE CHANNEL	N/A.

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 00570
MONUMENTATION SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHERS		

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00570
SLOPES: RESERVOIR	Gentle to moderate and heavily wooded.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	None.
SLOPES: CHANNEL VALLEY	The valleys below Lake Jean Dam and both the east and west dikes are generally heavily wooded with steep confining slopes. The streambeds are primarily steeply graded.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Five homes are located near the stream between five and seven miles downstream of the main embankment. It is estimated that 10 to 20 persons inhabit these five homes. The east dike shares much of the same downstream reach as the main embankment. Additionally, the communities of Central and Jamison City, Pennsylvania lie in the reach below the west dike where another six homes and as many as 25 persons could live near the stream.

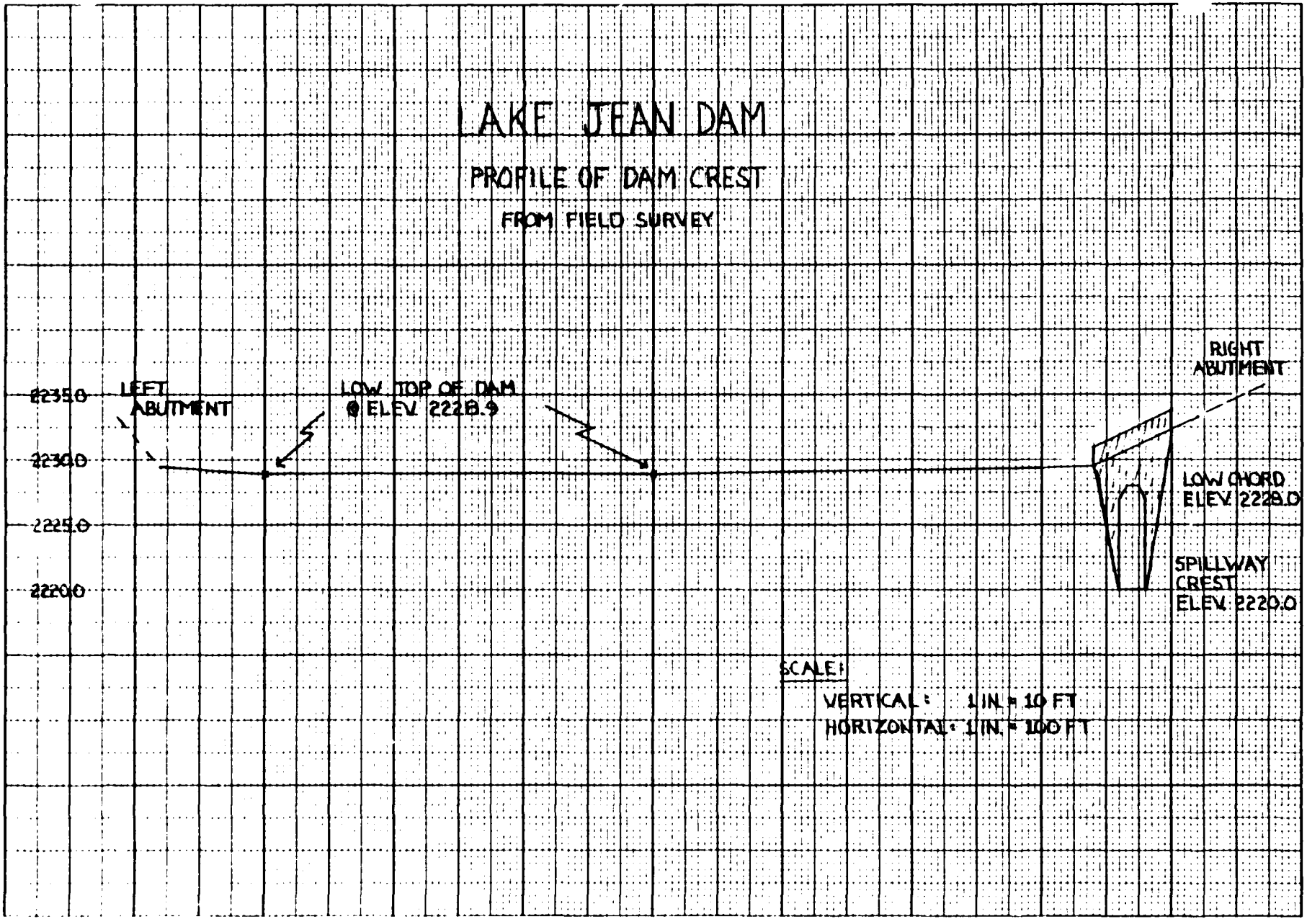


LAKE JEAN DAM
GENERAL PLAN - FIELD INSPECTION NOTES

LAKE JEAN DAM

PROFILE OF DAM CREST

FROM FIELD SURVEY



APPENDIX B

ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Lake Jean Dam

ITEM	REMARKS	NDI# PA - 00570
PERSONS INTERVIEWED AND TITLE	Jack Hugendubler - Bureau of Operations, PennDER Division of Completed Projects Brent Semmel - Park Superintendent.	
REGIONAL VICINITY MAP	See Figure 1, Appendix E.	
CONSTRUCTION HISTORY	Majority of information contained in PennDER files was compiled during the construction period. Included are partial payment requests, semi-monthly progress reports and miscellaneous correspondence. No construction photographs are available.	
AVAILABLE DRAWINGS	Complete set of 11 design drawings by Knappen, Tibbetts, Abbett Engineering Company, dated 12-3-49 are contained in PennDER files.	
TYPICAL DAM SECTIONS	See Figures 2, 3, 4, and 5, Appendix E.	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figure 4, Appendix E. See Figure 6, Appendix E. Discharge rating curves are not available.	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 00570
SPILLWAY: PLAN SECTION DETAILS	See Figures 2, 4, and 7, Appendix E.	
OPERATING EQUIP- MENT PLANS AND DETAILS	See Figure 6.	
DESIGN REPORTS	None available.	
GEOLOGY REPORTS	None available.	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	See Figures 8, 9, 10, and 11, Appendix E.	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA - 00570
BORROW SOURCES	Not known.
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Yearly visual inspections since 1965 by Operations Branch, Division of Flood Control which is now PennDER, Division of Completed Projects.
HIGH POOL RECORDS	June 1972 - 2.4 feet above spillway crest. October 1975 - 1.0 foot above spillway crest.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 00570
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	Annual maintenance inspections and records are contained in PennDER files. Routine maintenance performed twice yearly. Lubricate valve mechanisms, etc.	
OPERATION: RECORDS MANUAL	None. To be prepared by PennDER.	
OPERATIONAL PROCEDURES	Self-regulating.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Recently written by J. Hugendubler of PennDER entitled "Emergency Operation and Warning System, Lake Jean Dam". Available from PennDER.	
MISCELLANEOUS	Proposed drain at left abutment.	

GAI CONSULTANTS, INC.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # 00570
PENNDER ID # 40-16

SIZE OF DRAINAGE AREA: 3.0 square miles.

ELEVATION TOP NORMAL POOL: 2220.0 STORAGE CAPACITY: 1400 acre-feet.

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 2228.9 STORAGE CAPACITY: 3990 acre-feet.

SPILLWAY DATA

CREST ELEVATION: 2220.0 feet.

TYPE: Uncontrolled, rectangular, concrete and rock cut chute channel.

CREST LENGTH: 20 feet.

CHANNEL LENGTH: 1090 feet (includes approach and discharge channels).

SPILLOVER LOCATION: Right abutment.

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: 30-inch diameter C.I.P. encased in concrete.

LOCATION: Approximate center of embankment.

ENTRANCE INVERTS: 2204.0 feet.

EXIT INVERTS: 2203.1 feet.

EMERGENCY DRAWDOWN FACILITIES: 30-inch diameter sluice gate at inlet.

HYDROMETEOROLOGICAL GAGES

TYPE: None.

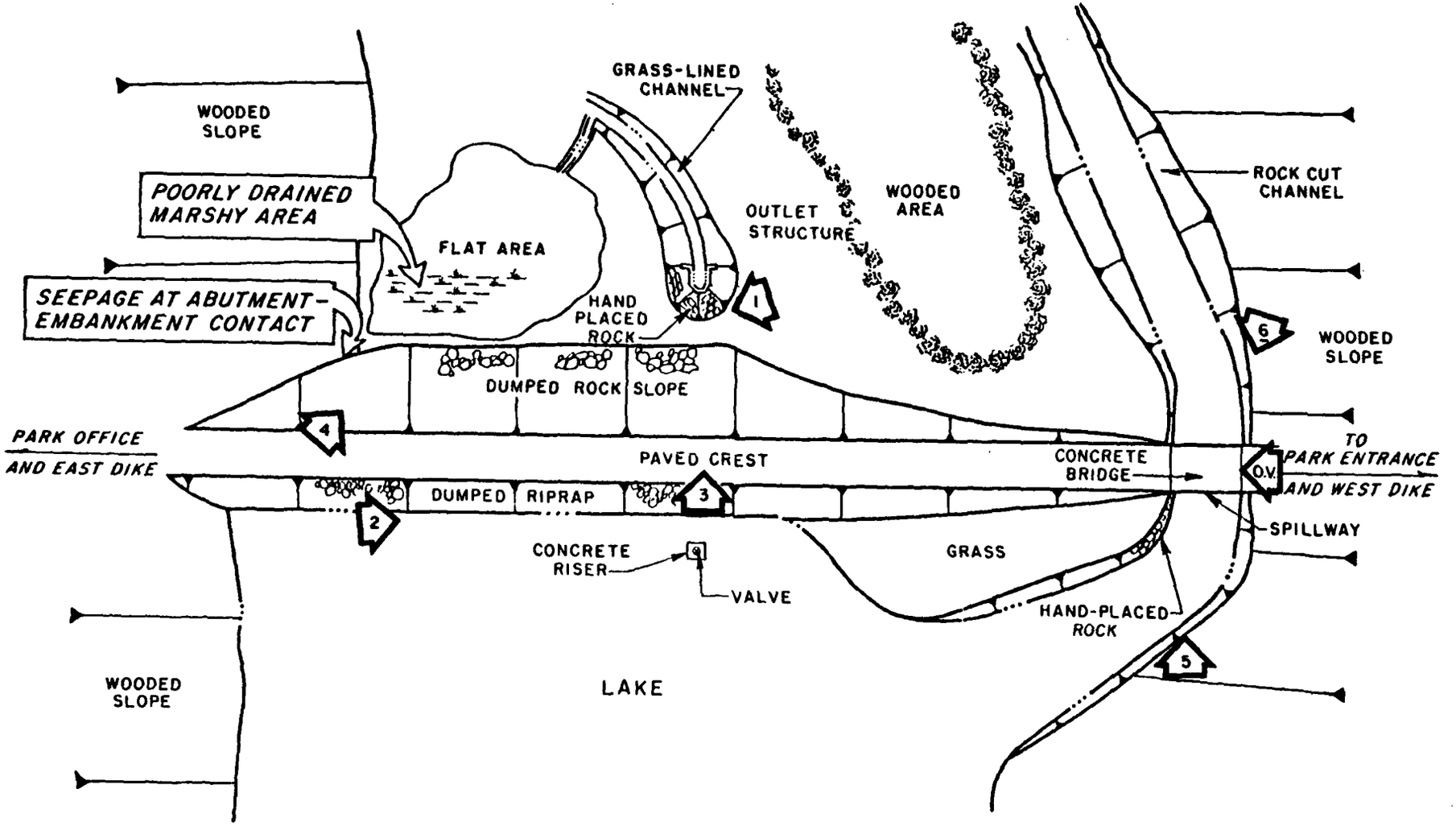
LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: 2.4 feet over weir (June 1972).

APPENDIX C

PHOTOGRAPHS



LAKE JEAN DAM
PHOTOGRAPH KEY MAP

PHOTOGRAPH 1 — View (looking toward the left abutment) of the rock covered downstream embankment slope and toe area.

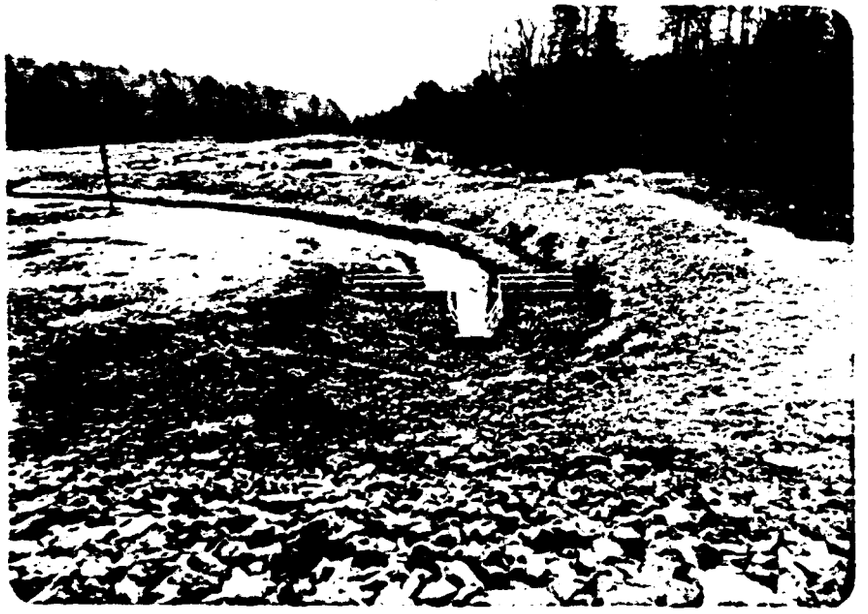
PHOTOGRAPH 2 — View (looking toward the right abutment) of the upstream embankment face.

PHOTOGRAPH 3 — View of the outlet structure located just beyond the downstream embankment toe.

PHOTOGRAPH 4 — View of a large marshy area located in the flats just beyond the downstream embankment toe and adjacent the left abutment.

1

2



3

4

PHOTOGRAPH 5 View (looking downstream) of the emergency spillway looking downstream from the right side of the approach channel.

PHOTOGRAPH 6 View (looking upstream) of the emergency spillway located at the right abutment.

PHOTOGRAPH 7 View across the crest of the west dike.

PHOTOGRAPH 8 View across the crest of the east dike.

5

6

7

8

APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: LAKE JEAN DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 INCHES/24 HOURS (1)

STATION	1	2	3
STATION DESCRIPTION	GANOGA LAKE (5)	LAKE JEAN	
DRAINAGE AREA (SQUARE MILES)	0.8	2.2	
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	0.8	3.0	
ADJUSTMENT OF PMF FOR DRAINAGE AREA LOCATION (%) (1)			
6 HOURS	116	116	
12 HOURS	126	126	
24 HOURS	135	135	
48 HOURS	141	141	
72 HOURS	144	144	
SNYDER HYDROGRAPH PARAMETERS			
ZONE (2)	13	13	
C_p (3)	0.50	0.50	
C_t (3)	1.85	1.85	
L' (MILES) (4)	0.6	1.0	
$t_p = C_t (L')^{0.6}$ (HOURS)	1.36	1.85	
SPILLWAY DATA			
CREST LENGTH (FEET)	12	20	
FREEBOARD (FEET)	2.7	8.9	

(1) HYDROMETEOROLOGICAL REPORT 40, U.S. WEATHER BUREAU, 1965.

(2) HYDROLOGIC ZONE DEFINED BY CORPS OF ENGINEERS, BALTIMORE DISTRICT, FOR DETERMINATION OF SNYDER COEFFICIENTS (C_p AND C_t).

(3) SNYDER COEFFICIENTS

(4) L' = LENGTH OF LONGEST WATERCOURSE FROM RESERVOIR INLET TO BASIN DIVIDE.

(5) GANOGA LAKE IS A NATURAL LAKE, WITH A MAN-MADE OUTLET STRUCTURE

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DSS DATE 4-28-80 PROJ. NO. 79-203-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 1 OF 21

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DAM STATISTICS

- HEIGHT OF DAM = 26 FEET (FIELD MEASUREMENT)

- NORMAL POOL STORAGE CAPACITY = 456×10^6 GALLONS
  = 1400 ACRE-FEET (SEE NOTE 1)

- MAXIMUM POOL STORAGE CAPACITY = 3990 AC-FT (SHEET 4; SEE NOTE 2)
  (AT LOW TOP OF DAM)

- DRAINAGE AREA = 3.0 SQUARE MILES (PLANIMETERED ON USGS 7.5' TOPO QUAD, RED ROCK, [illegible])
  GANOGA LAKE SUB-BASIN: 0.8 SQ. MI.
  LAKE JEAN SUB-BASIN: 2.2 SQ. MI.

ELEVATIONS:

TOP OF DAM (DESIGN):	2229.0	(FIG. 4)
TOP OF DAM (FIELD):	2228.7	
TOP OF WEST DIKE (DESIGN):	2229.0	(FIG. 2)
TOP OF WEST DIKE (FIELD):	2228.0	
TOP OF EAST DIKE (DESIGN):	2229.0	(FIG. 2)
TOP OF EAST DIKE (FIELD):	2227.0	
NORMAL POOL:	2220.0	(FIG. 2)
UPSTREAM INLET INVERT:	2204.0	(FIG. 5)
DOWNSTREAM OUTLET INVERT (DESIGN):	2203.0	(FIG. 5)
DOWNSTREAM OUTLET INVERT (FIELD):	2203.1	
STREAMBED AT DAM CENTERLINE:	≈2204	(FIG. 9)

- NOTE 1: OBTAINED FROM WATER RESOURCES INVENTORY FORM, LAKE JEAN DAM, FOUND IN REINDER FILES.

- NOTE 2: MAXIMUM POOL STORAGE BASED ON THE ASSUMPTION THAT THE EAST AND WEST DIKES ARE AT DESIGN ELEVATION.

UBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 5-28-80 PROJ. NO. 79-303-STO

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DAM CLASSIFICATION

DAM SIZE: INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION: HIGH (FIELD OBSERVATION)

REQUIRED SDF: PMF (REF 1, TABLE 3)

HYDROGRAPH PARAMETERS

THE WATERSHED CONSISTS OF TWO SUB-BASINS — THE UPSTREAM GANOGA LAKE SUB-BASIN, AND THE DOWNSTREAM MAIN BASIN — OR LAKE JEAN SUB-BASIN (SEE FIG. 1). INFLOW HYDROGRAPHS WILL BE COMPUTED FOR EACH SUB-BASIN. OUTFLOWS FROM THE GANOGA LAKE OUTLET FACILITIES WILL BE COMBINED WITH THE LAKE JEAN INFLOWS, AND ROUTED THROUGH THE RESERVOIR.

$C_t = 1.85$
$C_p = 0.50$

(SUPPLIED BY C.O.E., ZONE 13, NORTH BRANCH SUSQUEHANNA RIVER BASIN)

	GANOGA LAKE SUB-BASIN	LAKE JEAN SUB-BASIN
— LENGTH OF LONGEST WATERCOURSE FROM END OF RESERVOIR TO BASIN DIVIDE, L':	0.6 MI	1.0 MI.
- SNYDER'S STANDARD LAG: $t_p = C_t (L')^{0.6}$:	1.36 HRS	1.85 HRS

NOTE: SINCE L_{CA}, THE LENGTH OF THE LONGEST WATERCOURSE FROM THE RESERVOIR OUTLET TO A POINT OPPOSITE THE BASIN CENTROID, FOR EACH SUB-BASIN, IS LESS THAN THE RESERVOIR LENGTH (BY INSPECTION - SEE FIG. 1), THE SNYDER STANDARD LAG IS APPROXIMATED AS $t_p = C_t (L')^{0.6}$ HOURS (AS PER C.O.E.). STREAM LENGTHS WERE MEASURED ON USGS TOPO QUAD - RED ROCK, PA. HYDROGRAPH VARIABLES USED HERE ARE DEFINED IN REF. 2, IN SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH."

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

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I) LAKE JEAN

RESERVOIR STORAGE VOLUMES

- RESERVOIR SURFACE AREAS:

  - SURFACE AREA (S.A.) @ NORMAL POOL (ELEV 2220.0) = 245 ACRES (NOTE 1)
  - S.A. @ ELEV. 2240.0 = 450 ACRES
    (PLANIMETERED ON USGS TOPO QUAD, RED ROCK, PA)

IT IS ASSUMED THAT THE MODIFIED PRISMOIDAL RELATIONSHIP ADEQUATELY MODELS THE RESERVOIR SURFACE AREA - STORAGE RELATIONSHIP. (REF 14, p.15)

$$\Delta V_{1-2} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 \cdot A_2}\right)$$

WHERE ΔV_{1-2} = INCREMENTAL VOLUME BETWEEN ELEVATIONS 1 & 2, IN AC-FT,
h = ELEVATION 1 − ELEVATION 2, IN FT,
A_1 = S.A. @ ELEVATION 1, IN ACRES,
A_2 = S.A. @ ELEVATION 2, IN ACRES.

ALSO, $$A_i = A_o + \left(\frac{\Delta SA}{\Delta H} \times H\right)$$

WHERE A_i = S.A. @ ELEV i, IN ACRES,
A_o = S.A. @ NORMAL POOL = 245 ACRES,
$\frac{\Delta SA}{\Delta H}$ = RATE OF RESERVOIR AREA INCREASE PER FOOT RISE IN WATER LEVEL.

→ $\frac{\Delta SA}{\Delta H} = \frac{450 - 245}{2240 - 2220} = 10.3$ AC-FT/FT.

→ H = ELEV i − 2220.0

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

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ELEVATION - STORAGE RELATIONSHIP:

	ELEVATION (FT)	A_i (AC)	ΔV_{1-2} (AC-FT)	TOTAL VOLUME * (AC-FT)
	2203.0	0	—	0
(NORMAL POOL)	2220.0	245	—	1400
	2225.0	297	1353	2750
(LOW TOP OF EAST DIKE)	2227.0	317	614	3370
(LOW TOP OF WEST DIKE)	2228.0	327	322	3690
(LOW TOP OF DAM)	2228.9	337	299	3990
	2230.0	348	377	4370
	2231.0	358	353	4720
	2232.0	369	363	5080
	2233.0	379	374	5460
	2234.0	389	384	5840
	2235.0	400	394	6230

* - ROUNDED OFF TO NEAREST 10-ACRE-FEET. ZERO-STORAGE ELEVATION TAKEN FROM FIG. 6.

JBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 4-30-80 PROJ. NO. 79-303-570

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PMP CALCULATIONS

- FROM REF 9, FIG. 2, OBTAIN PMP VALUE FOR A BASIN OF DRAINAGE AREA 200 SQUARE MILES, FOR A DURATION OF 24 HOURS:

  PRECIP = 22.2 INCHES

- FROM REF 9, FIG. 1, THE GEOGRAPHIC ADJUSTMENT FACTOR = 99%

- AREA CORRECTION FACTOR (REF. 9):

DURATION (HRS):	6	12	24	48	72
FACTOR (%):	117.5	127.0	136.0	142.5	145.0

- TOTAL CORRECTION FACTOR (0.99 X AREA CORRECTION FACTOR)

DURATION (HRS):	6	12	24	48	72
FACTOR (%):	116	126	135	141	144

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AND FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN) FOR A DRAINAGE AREA OF 3.0 SQUARE MILES IS 0.80.

  (REF 4, p. 48)

UBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 4-30-80 PROJ. NO. 79-203-570

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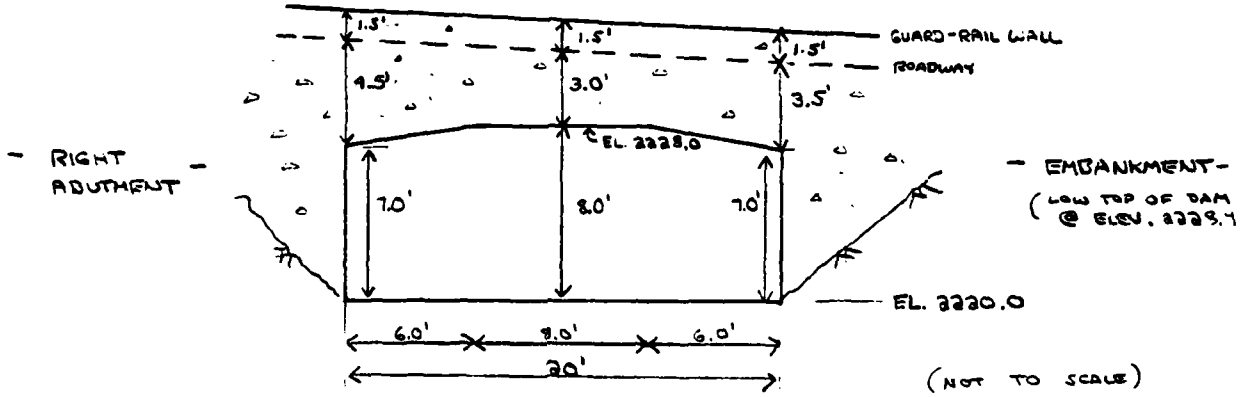
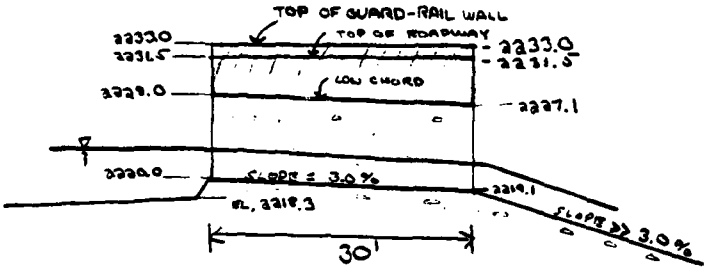
SPILLWAY CAPACITY AND RATING CURVE

CROSS-SECTION: - LOOKING UPSTREAM - (UPSTREAM END DIMENSIONS)



(NOT TO SCALE)

PROFILE OF SPILLWAY AT ℄:



(BASED ON FIELD NOTES AND FIGURES 4, 7)

(NOT TO SCALE)

THE SPILLWAY CONSISTS OF A RECTANGULAR CONCRETE CHUTE CHANNEL WITH DISCHARGES AT LOW HEADS CONTROLLED BY A BROAD-CRESTED WEIR, AND DISCHARGES AT HEADS GREATER THAN ABOUT 5.2 CONTROLLED BY ORIFICE FLOW.

JBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 4-30-80 PROJ. NO. 79-203-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 7 OF 21

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CAPACITY OF SPILLWAY:

DISCHARGE OVER THE BROAD-CRESTED WEIR CAN BE ESTIMATED BY THE RELATION

$$Q = CLH^{3/2} \qquad \text{(REF 5, p. 5-23)}$$

WHERE Q = DISCHARGE OVER WEIR, IN CFS,
C = DISCHARGE COEFFICIENT,
L = LENGTH OF WEIR CREST = 20 FT,
H = TOTAL HEAD ON WEIR CREST, IN FT.

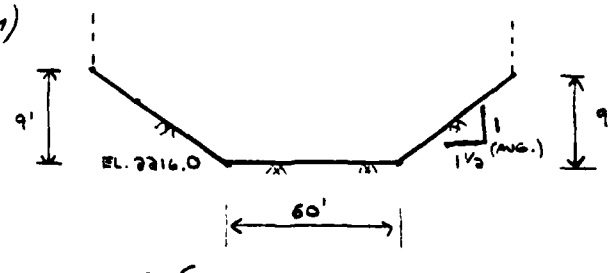
THE DISCHARGE COEFFICIENT WILL BE ASSUMED TO BE IN THE ORDER OF 3.0, AS OBTAINED FROM REF 5, TABLE 5-5, FOR BROAD-CRESTED WEIRS WITH CRESTS INCLINED SLIGHTLY DOWNWARD.

APPROACH CHANNEL LOSSES:

- LENGTH OF APPROACH CHANNEL = 380'

- ASSUMED AVERAGE CROSS-SECTION OF APPROACH CHANNEL, BASED ON FIGURE 7:

(LOOKING DOWNSTREAM)



- AT ELEV. 2228.0 (LOW CHORD ON BRIDGE OVER SPILLWAY), AVG. DEPTH = 12.0 FT.

JBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DAS DATE 4-30-80 PROJ. NO. 79-303-570

CHKD. BY WJV DATE 5-4-80 SHEET NO. 8 OF 21

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$$\text{FLOW AREA} \approx \left[\frac{[60+(3\times9.0)]+60}{2}\times 9\right] + \left[[60+(3\times9.0)]\times 3.0\right]$$
$$\approx \underline{923}\ FT^2$$

- INITIAL ESTIMATE OF DISCHARGE :

$$Q = CLH^{3/2} \approx (3.0)(20)(8^{3/2}) \approx \underline{1358}\ CFS$$

- AVG. VELOCITY IN APPROACH CHANNEL :

$$V_A = Q/A = \frac{1358}{923} = \underline{1.5}\ FT/SEC$$

AVG. VELOCITY HEAD : $h_a = \frac{V_a^2}{2g} = \frac{1.5^2}{64.4} \approx \underline{0.03}\ FT$

- SINCE THE VELOCITY HEAD IS LOW, THE APPROACH CHANNEL ENTRANCE LOSS WILL BE NEGLIGIBLE ($= 0.1 \times h_a = 0.003$). (REF 4, p. 379)

- APPROACH CHANNEL FRICTION LOSS :

$$h_F = \left[\frac{V_a\, n}{1.49\, R^{2/3}}\right]^2 \times L_c \qquad \text{(REF 7, p. 279)}$$

WHERE L_c = LENGTH OF APPROACH CHANNEL = $\underline{380}$ FT,
n = MANNING'S ROUGHNESS COEFFICIENT = 0.035 (FIELD ESTIMATE),
R = HYDRAULIC RADIUS = FLOW AREA / WETTED PERIMETER.

$$P_{WETTED} = 60 + 16 + 16 = \underline{92}\ FT$$

$$\therefore R_{AVG} = \frac{923}{92} = \underline{10.0}\ FT$$

$$\therefore h_F = \left[\frac{(1.5)(0.035)}{(1.49)(10.0)^{2/3}}\right]^2 \times 380 \approx \underline{\underline{0.02}}\ FT$$

- FROM THIS ANALYSIS, IT IS SEEN THAT APPROACH CHANNEL LOSSES ARE NEGLIGIBLE.

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY JJS DATE 6/1-80 PROJ. NO. 79-303-570
CHKD. BY WJV DATE 6-4-80 SHEET NO. 9 OF 21

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① SPILLWAY RATING CURVE FOR RESERVOIR ELEVATIONS BELOW LOW CHORD :

	RESERVOIR ELEVATION (FT)	H (FT)	Q_1* (CFS)
(NORMAL POOL)	2220.0	—	0
	2221.0	1.0	60
	2222.0	2.0	170
	2223.0	3.0	310
	2224.0	4.0	480
	2225.0	5.0	670
	2226.0	6.0	880
	2227.0	7.0	1110
(LOW CHORD)	2228.0	8.0	1360

* $Q_1 = CLH^{3/2} = (3.0)(20)H^{3/2}$

② SPILLWAY DISCHARGE : ORIFICE FLOW UNDER BRIDGE :

FOR RESERVOIR ELEVATIONS NEAR AND ABOVE THE LOW CHORD OF THE BRIDGE (ELEV. 2228.0), ASSUME THAT DISCHARGE UNDER THE BRIDGE CAN BE ESTIMATED BY THE EQUATIONS OF FLOW FOR BOX CULVERTS UNDER INLET CONTROL (SEE NOTE 3).

FOR $H/D < 1.2$, $Q = \frac{2}{3} C_B B H \sqrt{\frac{2}{3} g H}$

FOR $H/D > 1.2$, $Q = C_H B D \sqrt{2g(H - C_D D)}$

NOTE 3: FROM OPEN CHANNEL FLOW, F.M. HENDERSON, MACMILLAN PUBLISHING CO., INC., NEW YORK, 1966.

UBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY JDS DATE 5-1-80 PROJ. NO. 79-203-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 10 OF 21

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WHERE Q = FLOW THROUGH CULVERT, IN CFS,
B = WIDTH OF CULVERT = 20 FT,
D = HEIGHT OF CULVERT = 8 FT,
H = HEAD ON CULVERT, IN FT,
C_B = DISCHARGE COEFFICIENT = 0.9 (SQUARE-EDGED ENTRANCE),
C_H = DISCHARGE COEFFICIENT = 0.6 (SQUARE-EDGED ENTRANCE),
g = GRAVITATIONAL CONSTANT = 32.2 FT/SEC^2.

SINCE THE SHAPE OF THE OPENING IS NOT RECTANGULAR, A CORRECTION FACTOR FOR AREA OF FLOW MUST BE INCLUDED: (SEE SHEET 6)

$$A_{ACTUAL} = (7 \times 20) + \left[\left(\frac{8 \times 20}{2}\right)(1)\right] = 154 \text{ FT}^2$$

$$A_{RECTANGULAR} = 8 \times 20 = 160 \text{ FT}^2$$

$$\text{CORRECTION FACTOR} = \frac{154}{160} = 0.96$$

	RESERVOIR ELEVATION (FT)	H (FT)	H/D (FT)	$Q_{INITIAL}$* (CFS)	$Q_{CORRECTED}$** (CFS)	
(LOW CHORD)	2228.0	8.0	1.0	1258	1210	
(LOW TOP OF DAM)	2228.9	8.9	1.1	1476	1420	→ SPILLWAY CAPACITY.
	2229.0	9.0	1.1	1501	1440	
	2230.0	10.0	1.3	1757	1690	
	2231.0	11.0	1.4	1918	1840	
	2232.0	12.0	1.5	2067	1980	
	2233.0	13.0	1.6	2206	2120	
	2234.0	14.0	1.8	2337	2240	

* - FROM EQUATIONS ON SHEET 9.

** - $Q_{CORRECTED} = Q_{INITIAL} \times 0.96$.

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY JDS DATE 5-5-80 PROJ. NO. 79-203-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 11 OF 21

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③ DISCHARGE OVER EMBANKMENT AND SPILLWAY BRIDGE :

DISCHARGE OVER THE SPILLWAY BRIDGE WILL BE INCLUDED AS PART OF THE DAM OVERTOPPING CALCULATIONS, SINCE THE MINIMUM TOP OF BRIDGE (OR GUARD RAIL WALL) ELEVATION IS WELL ABOVE THE LOW TOP OF DAM ELEVATION.

EMBANKMENT LENGTH OVERTOPPED VS. RESERVOIR ELEVATION : (MAIN EMBANKMENT)

RESERVOIR ELEVATION (FT)	EMBANKMENT LENGTH (FT)
2229.9	0
2229.0	370
2229.2	550
2229.5	720
2230.0	725
2230.5	730
2231.0	735
2232.0	760
2233.0	800
2234.0	850

(BASED ON FIELD MEASUREMENTS AND FIG. 4 ; INCLUDES SPILLWAY BRIDGE.)

ASSUME THAT THE EMBANKMENT BEHAVES ESSENTIALLY AS A BROAD-CRESTED WEIR WHEN OVERTOPPING OCCURS. THUS, THE DISCHARGE CAN BE ESTIMATED BY THE RELATIONSHIP

$$Q = CLH^{3/2}$$ (SEE SHEET 7)

WHERE $C = f(\text{HEAD, BREADTH})$.

JBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 5-5-80 PROJ. NO. 79-303-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 12 OF 21

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ASSUME THAT INCREMENTAL DISCHARGES FOR SUCCESSIVE RESERVOIR ELEVATIONS ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW CAN BE ESTIMATED AS $H_i [(L_1+L_2)/2]$, WHERE L_1 = LENGTH OF EMBANKMENT AT HIGHER ELEVATION, L_2 = LENGTH AT LOWER ELEVATION, H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW-AREA WEIGHTED" HEAD CAN BE ESTIMATED AS $H_w = (\text{TOTAL FLOW AREA}/L_1)$.

EMBANKMENT RATING TABLE:

RESERVOIR ELEVATION (FT)	L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	① INCREMENTAL FLOW AREA, A_i (FT^2)	TOTAL FLOW AREA, A_T (FT^2)	② WEIGHTED HEAD, H_w (FT)	③ $\frac{H_w}{l}$	④ C	⑤ Q (CFS)
3228.9	0	—	0	0	0	0	—	—	0
3229.0	370	0	0.1	19	19	0.1	0.004	2.93	30
3229.2	550	370	0.2	92	111	0.2	0.01	2.97	150
3229.5	720	550	0.3	191	302	0.4	0.02	3.01	550
3230.0	725	720	0.5	361	663	0.9	0.03	3.03	1880
3230.5	730	725	0.5	364	1027	1.4	0.05	3.04	3680
3231.0	735	730	0.5	366	1393	1.9	0.07	3.04	5850
3232.0	760	735	1.0	748	2141	2.8	0.11	3.05	10,860
3233.0	800	760	1.0	780	2921	3.7	0.14	3.05	17,370
3234.0	850	800	1.0	825	3746	4.4	0.17	3.06	24,010

① $A_i = H_i \left(\frac{L_1+L_2}{2}\right)$

② $H_w = (A_T/L_1)$

③ l = BREADTH OF CREST = 26 FT (FIELD MEASUREMENT)

④ $C = f(H,l)$, FROM REF 12, FIG. 24.

⑤ $Q = CL_1H_w^{3/2}$

(NOTE: THE WATERSHED DIVIDE IN THE AREA JUST NORTHEAST OF THE EAST DIKE IS BETWEEN ELEVATIONS 3225.0 AND 3230.0 (ASSUMED TO BE AT ELEV. 3229.0). THUS, AT ELEVATIONS GREATER THAN THIS, SOME WATER WILL DISCHARGE INTO THE LAKE LEIGH WATERSHED. HOWEVER, THE WATER SURFACE IS NOT EXPECTED TO RISE MUCH ABOVE ELEV. 3229.0, AND THIS LOSS WILL BE ASSUMED NEGLIGIBLE IN THE COMPUTATION OF THE TOTAL FACILITY DISCHARGE CAPABILITIES.)

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

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⑨ RATING TABLE - EAST DIKE :

- ASSUME THAT THE DIKE BEHAVES ESSENTIALLY AS A BROAD-CRESTED WEIR WHEN OVERTOPPING OCCURS. THUS, THE RATING TABLE IS DERIVED SIMILARLY TO THAT OF THE MAIN DAM, PRESENTED ON SHEETS 11-12.

A) RATING TABLE - EXISTING CONDITIONS :

	Reservoir Elevation (FT)	① L_1 (FT)	L_2 (FT)	Incremental Head, H_i (FT)	② Incremental Flow Area, A_i (FT^2)	Total Flow Area, A_T (FT^2)	③ Weighted Head, H_w (FT)	④ Q (CFS)
(Top of Dike)	3337.0	0	—	—	—	—	—	0
	3337.01	570	0	—	—	—	—	0
	3338.0	580	570	1.0	575	575	1.0	1790
(Low Top of Main Dam)	3338.9	590	580	0.9	537	1102	1.9	4770
	3339.0	590	590	0.1	59	1161	2.0	5160
	3339.5	595	590	0.5	296	1457	2.4	6840
	3340.0	600	595	0.5	299	1756	2.9	9160
	3340.5	620	600	0.5	305	2061	3.3	11,480
	3341.0	635	620	0.5	314	2375	3.7	13,960
	3342.0	670	635	1.0	653	3028	4.5	19,760

B) RATING TABLE - DESIGN CONDITIONS :

3339.0	0	—	—	—	—	—	0
3339.01	590	0	—	—	—	—	0
3339.5	595	590	0.5	296	296	0.5	650
3340.0	600	595	0.5	299	595	1.0	1850
3340.5	620	600	0.5	305	900	1.5	3520
3341.0	635	620	0.5	314	1214	1.9	5140

① FROM FIELD MEASUREMENTS AND FIG. 2

② $A_i = H_i [(L_1+L_2)/2]$

③ $H_w = A_T / L_1$

④ $Q = C L_1 H_w^{3/2}$; ASSUME $C = 3.09$ FOR ALL CASES (SEE 12, FIG. 2) ASSUMING BREADTH (L_1) = 3FT, AS PER FIG. 2.

UBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY JDS DATE 5-5-80 PROJ. NO. 79-203-570

CHKD. BY WJV DATE 6-4-80 SHEET NO. 14 OF 21

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⑤ RATING CURVE FOR WEST DIKE:

IN ORDER TO COMPUTE THE RATING TABLE FOR THE WEST DIKE, IT WILL BE ANALYZED IN A MANNER SIMILAR TO THAT OF THE EAST DIKE AND TO THAT OF THE MAIN DAM (SEE SHEETS 11-13). AGAIN, DISCHARGE WILL BE ESTIMATED BY USE OF THE WEIR EQUATION, $Q = CLH^{3/2}$.

A) RATING TABLE – EXISTING CONDITIONS:

	RESERVOIR ELEVATION (FT)	① L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	② INCREMENTAL FLOW AREA, A_i (FT^2)	TOTAL FLOW AREA, A_T (FT^2)	③ WEIGHTED HEAD, H_w (FT)	④ Q (CFS)
(TOP OF DIKE)	3228.0	0	—	—	—	—	—	0
	3228.01	950	0	—	—	—	—	0
(LOW TOP OF MAIN DAM)	3228.9	990	950	0.9	873	873	0.9	3610
	3229.0	990	990	0.1	99	972	1.0	3060
	3229.5	1010	990	0.5	500	1472	1.5	5730
	3230.0	1030	1010	0.5	510	1982	1.9	8340
	3231.0	1070	1030	1.0	1050	3032	3.8	15,490

B) RATING TABLE – DESIGN CONDITIONS:

3229.0	0	—	—	—	—	—	0
3229.01	990	0	—	—	—	—	0
3229.5	1010	990	0.5	500	500	0.5	1100
3230.0	1030	1010	0.5	510	1010	1.0	3180
3230.5	1050	1030	0.5	520	1530	1.5	5960
3231.0	1070	1050	0.5	530	2060	1.9	8660

① FROM FIELD MEASUREMENTS, FIG. 2, AND USGS TOPO QUAD, RED ROCK, PA.

② $A_i = H_i[(L_1+L_2)/2]$

③ $H_w = A_T/L_1$

④ $Q = CL_1H_w^{3/2}$, ASSUME C = 3.09 FOR ALL CASES (REF 12, FIG. 24), ASSUMING WEIR BREADTH (L) = 3 FT, AS PER FIG. 2.

JBJECT DAM SAFETY INSPECTION
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TOTAL FACILITY RATING CURVE

SINCE THE EAST AND WEST DIKES ARE 1-2 FEET LOWER THAN THE MAIN DAM, THE RESERVOIR AND SPILLWAY CAPACITIES WILL BE ANALYZED UNDER TWO SETS OF CONDITIONS: (A) EAST AND WEST DIKES AT PRESENT ELEVATIONS
(B) EAST AND WEST DIKES AT DESIGN ELEVATIONS

RESERVOIR ELEVATION (FT)	① $Q_{SPILLWAY}$ (CFS)	② $Q_{EMBANKMENT\ MAIN\ DAM}$ (CFS)	③ $Q_{EAST\ DIKE}$ PRESENT ELEVATION (CFS)	④ $Q_{WEST\ DIKE}$ PRESENT ELEVATION (CFS)	(A)⑤ Q_{TOTAL} (CFS)	③ $Q_{EAST\ DIKE}$ DESIGN ELEVATION (CFS)	④ $Q_{WEST\ DIKE}$ DESIGN ELEVATION (CFS)	(B)⑤ Q_{TOTAL} (CFS)
2220.0	0	—	—	—	0	—	-	0
2221.0	60	—	—	—	60	—	—	60
2222.0	170	—	—	—	170	—	—	170
2223.0	310	—	—	—	310	—	—	310
2224.0	480	—	—	—	480	—	—	480
2225.0	670	—	—	—	670	—	—	670
2226.0	880	—	—	—	880	—	—	880
2227.0	1110	—	0	—	1110	—	-	1110
2228.0	1210	—	1790	0	3000	—	—	1210
2228.9	1420	0	4770	2610	8800	—	-	1420
2229.0	1440	30	5160	3060	9690	0	0	1470
2229.2	1490⑥	150	5830⑧	4130⑥	11,600	260⑧	440⑥	2340
2229.5	1570⑥	550	6840	5730	14,690	650	1100	3870
2230.0	1690	1880	9160	8340	21,070	1850	3180	8600
2230.5	1770⑥	3680	11,480	11,500⑦	28,430	3520	5960	14,930
2231.0	1840	5850	13,960	15,490	37,140	5140	8660	21,490

① FROM SHEETS 9, 10, AT ELEV. 2228.0, USE VALUE FROM TABLE, SHEET 10.
② FROM SHEET 12
③ FROM SHEET 13
④ FROM SHEET 14
⑤ $Q_{TOTAL} = Q_{SPILLWAY} + Q_{EMBANKMENT\ MAIN\ DAM} + Q_{EAST\ DIKE} + Q_{WEST\ DIKE}$
⑥ BY LINEAR INTERPOLATION
⑦ BY LOG-LOG INTERPOLATION

SUBJECT DAM SAFETY INSPECTION
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II) GANOGA LAKE

GANOGA LAKE, WHICH IS LOCATED UPSTREAM OF LAKE JEAN, IS ESSENTIALLY A NATURAL LAKE, WITH DISCHARGES CONTROLLED BY A MAN-MADE OUTLET STRUCTURE. ALONG THE SOUTHERN EDGE OF THE LAKE, AT WHICH THE OUTLET STRUCTURE IS LOCATED, AN EARTH FILL "EMBANKMENT" PROVIDES ABOUT 2.7 FEET OF FREEBOARD, RESULTING IN A SIGNIFICANT STORAGE VOLUME WITHIN THE LAKE. THUS, THE FACILITY, WHICH DRAINS OVER ONE-FOURTH OF THE TOTAL LAKE JEAN WATERSHED AREA, IS TREATED AS AN UPSTREAM DAM.

STORAGE VOLUMES

SURFACE AREAS:

S.A. @ ELEV. 2266.0 ("NORMAL POOL") = 79 ACRES
S.A. @ ELEV. 2280.0 = 143 ACRES (PLANIMETERED ON USGS TOPO - RED ROCK, PA)

— ASSUME THAT THE MODIFIED PRISMOIDAL RELATIONSHIP ADEQUATELY MODELS THE SURFACE AREA – STORAGE RELATIONSHIP (SEE SHEET 3). ALSO, ASSUME THAT SURFACE AREAS CORRESPONDING TO ELEVATIONS BETWEEN THOSE GIVEN ABOVE CAN BE LINEARLY INTERPOLATED.

	ELEVATION (FT)	A_i (AC) ①	ΔV_{i-j} (AC-FT) ②	TOTAL VOLUME (AC-FT) ③
	2244.0	—	—	0
(NORMAL POOL)	2266.0	79	—	374
	2267.0	84	81.5	456
	2268.0	88	86.0	542
(TOP OF FILL)	2268.7	91	62.6	604
	2269.0	93	27.6	632
	2270.0	97	95.0	727
	2271.0	102	99.5	826
	2273.0	111	212.9	1039

JBJECT DAM SAFETY INSPECTION

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① SURFACE AREAS BY LINEAR INTERPOLATION.

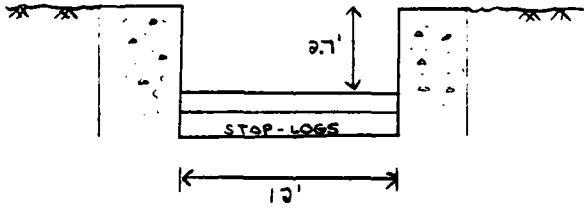
② $\Delta V_{1-2} \simeq \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 \cdot A_2}\right)$ — (SEE SHEET 3)

③ → ZERO-STORAGE @ ELEV. 2244 → MAX. DEPTH IN LAKE = 22 FT, AS REPORTED BY CARETAKER.

→ STORAGE @ NORMAL POOL = 122×10^6 GAL = 374 AC-FT, FOUND IN "DAMS, RESERVOIRS, AND NATURAL LAKES," WATER RESOURCES BULLETIN No. 5, COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF FORESTS AND WATER, HARRISBURG, PA, 1970.

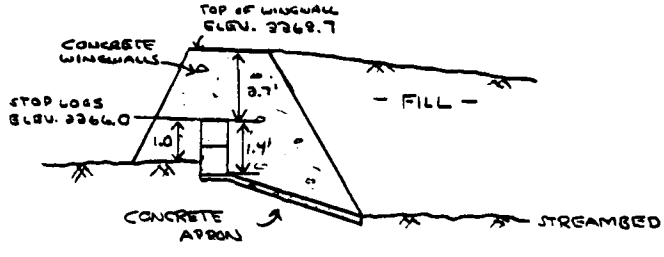
CAPACITY OF OUTLET STRUCTURE

CROSS-SECTION:



(NOT TO SCALE)

PROFILE:



(NOT TO SCALE)

(SKETCHES BASED ON FIELD MEASUREMENTS AND OBSERVATIONS.)

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THE SPILLWAY CONSISTS OF A RECTANGULAR (WOOD) STOP-LOG STRUCTURE WITH CONCRETE SIDEWALLS AND DOWNSTREAM APRON, AS SHOWN ON SHEET 17. DISCHARGE OVER THE STRUCTURE, WHICH IS ESSENTIALLY A SHARP-CRESTED WEIR, CAN BE ESTIMATED BY THE RELATION

$$Q = CLH^{3/2} \qquad \text{(Ref 5, p. 5-3)}$$

WHERE Q = DISCHARGE, IN CFS,
H = HEAD, IN FT,
L = LENGTH OF WEIR = 12 FT,
C = COEFFICIENT OF DISCHARGE. ASSUME $C = 3.32$, FROM REF 5, TABLE 5-3.

SPILLWAY RATING TABLE:

	ELEVATION (FT)	H (FT)	Q (CFS)
	2266.0	—	0
	2267.0	1.0	40
	2268.0	2.0	110
(TOP OF FILL)	2268.7	2.7	180
	2269.0	3.0	210
	2269.5	3.5	260
	2270.0	4.0	320
	2270.5	4.5	380
	2271.0	5.0	450
	2272.0	6.0	590
	2273.0	7.0	740

NOTE: THE POSSIBILITY OF SUBMERGENCE OF THE LAKE GARZA WEIR IS CONSERVATIVELY IGNORED IN THIS ANALYSIS, SINCE MOST OF THE LAKE DISCHARGE WILL BE OVER THE "EMBANKMENT" RATHER THAN THE WEIR.

UBJECT DAM SAFETY INSPECTION
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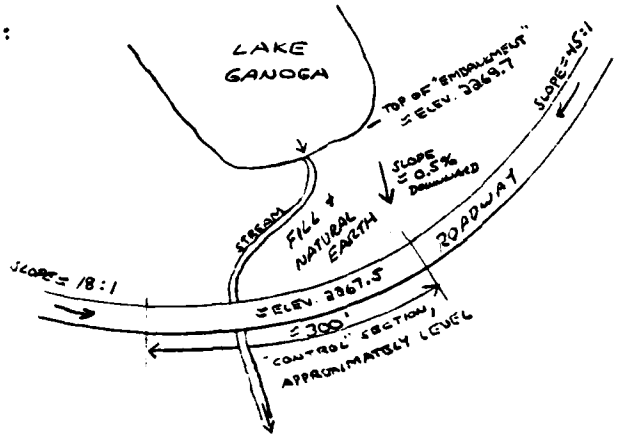
"EMBANKMENT" RATING CURVE

THE AREA BETWEEN THE SOUTHERN SHORE OF THE LAKE AND THE DOWNSTREAM ROADWAY CONSISTS OF NATURAL GROUND AND FILL, ON A VERY MILD SLOPE (= ½ %). THE ROADWAY IS ABOUT 250 FEET DOWNSTREAM FROM THE LAKE.

PLAN:



(NOT TO SCALE)

(FROM FIELD OBSERVATIONS AND USGS TOPO QUAD - RED ROCK, PA)

IT WILL BE ASSUMED THAT DISCHARGE OVER THE FILL AREA WILL BE CONTROLLED BY CRITICAL FLOW AT THE ROADWAY, AS SHOWN ABOVE. IT WILL ALSO BE ASSUMED THAT UNIFORM FLOW OCCURS BETWEEN THE LAKE AND THE ROADWAY. THUS, THE DEPTH OF WATER ON THE ROADWAY JUST UPSTREAM OF THE CONTROL SECTION WILL BE APPROXIMATELY EQUAL TO THE DEPTH OF WATER ON THE UPSTREAM PORTION OF THE "EMBANKMENT".

DISCHARGE CAN BE ESTIMATED BY THE RELATIONSHIP

$$Q = CLH^{3/2}$$ (SEE SHEET 7)

WHERE $C = 3.087$. (REF 5, p. 5-24)

SUBJECT DAM SAFETY INSPECTION
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ASSUME THAT INCREMENTAL DISCHARGES FOR SUCCESSIVE RESERVOIR ELEVATIONS ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW CAN BE ESTIMATED AS $H_i[(L_1+L_2)/2]$, WHERE L_1 = LENGTH OF EMBANKMENT OVERTOPPED AT HIGHER ELEVATION, L_2 = LENGTH AT LOWER ELEVATION, H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW-AREA" WEIGHTED HEAD CAN BE ESTIMATED AS H_w = (TOTAL FLOW AREA/L_1).

ELEVATION (FT)	① L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	② INCREMENTAL AREA, A_i (FT^2)	TOTAL FLOW AREA, A_T (FT^2)	③ WEIGHTED HEAD, H_w (FT)	④ Q (CFS)
2268.70	0	—	—	—	—	—	—
2268.71	300	0	—	—	—	-	0
2269.0	320	300	0.3	93	93	0.3	160
2269.5	350	320	0.5	168	261	0.7	630
2270.0	380	350	0.5	183	444	1.2	1540
2270.5	410	380	0.5	198	642	1.6	2560
2271.0	440	410	0.5	213	855	1.9	3560
2272.0	510	440	1.0	475	1330	2.6	6600
2273.0	570	510	1.0	540	1870	3.3	10,550

① BASED ON TRAPEZOIDAL AREA OF 300 FT BOTTOM WIDTH, SIDE-SLOPES OF 18:1 AND 45:1 (SEE SHEET 19).

② $A_i = H_i\left(\frac{L_1+L_2}{2}\right)$

③ $H_w = A_T/L_1$

④ $Q = 3.087\, L_1 H_w^{3/2}$

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GANOGA LAKE: TOTAL FACILITY RATING CURVE

	ELEVATION (FT)	Q SPILLWAY (CFS)	Q EMBANKMENT (CFS)	Q TOTAL (CFS)
	2266.0	0	—	0
	2267.0	40	—	40
	2268.0	110	—	110
(TOP OF FILL)	2268.7	180	0	180
	2269.0	210	160	370
	2269.5	260	630	890
	2270.0	320	1540	1860
	2270.5	380	2560	2940
	2271.0	450	3560	4010
	2272.0	590	6600	7190
	2273.0	740	10,550	11,290

DAM SAFETY INSPECTION
LAKE JEAN DAM *** OVERTOPPING ANALYSIS - EXISTING CONDITIONS ***
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1
RTIOS= .50 .60 .70 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

GANOGA LAKE INFLOW COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.80	0.00	3.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.20	116.00	126.00	135.00	141.00	144.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

INITIAL & CONSTANT RAINFALL LOSSES, AS PER C.O.E.

LOSS DATA

LNUPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.36 CP= .50 NTA= 0

BASE FLOW PARAMETERS AS PER C.O.E.

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.93 AND R= 7.33 INTERVALS

UNIT HYDROGRAPH 42 END-OF-PERIOD ORDINATES, LAG= 1.37 HOURS, CP= .50 VOL= 1.00

13.	38.	96.	144.	179.	191.	178.	155.	135.	118.
103.	90.	78.	68.	60.	52.	45.	40.	35.	30.
26.	23.	20.	17.	15.	13.	12.	10.	9.	8.
7.	6.	5.	4.	4.	3.	3.	3.	2.	2.
2.	1.								

END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.57	22.95	2.62	48131.
										(650.)(583.)(67.)(1362.92)			

OVERTOPPING ANALYSIS
(EXISTING CONDITIONS)

SUMMARY INPUT/OUTPUT SHEETS

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY BJS DATE 6-4-80 PROJ. NO. 79-303-570
CHKD. BY DLB DATE 6-9-80 SHEET NO. A OF J

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LOCAL INFLOW HYDROGRAPHS, GANOGA LAKE.

0.5PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1110.	727.	244.	84.	24068.
CMS	31.	21.	7.	2.	682.
INCHES		8.45	11.36	11.66	11.66
MM		214.65	288.64	296.18	296.18
AC-FT		360.	485.	497.	497.
THOUS CU M		445.	598.	613.	613.

0.7PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1554.	1017.	342.	117.	33695.
CMS	44.	29.	10.	3.	954.
INCHES		11.83	15.91	16.33	16.33
MM		300.51	404.10	414.66	414.66
AC-FT		505.	678.	696.	696.
THOUS CU M		622.	837.	859.	859.

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2220.	1454.	489.	167.	48136.
CMS	63.	41.	14.	5.	1363.
INCHES		16.90	22.73	23.32	23.32
MM		429.30	577.28	592.37	592.37
AC-FT		721.	969.	995.	995.
THOUS CU M		889.	1196.	1227.	1227.

****

HYDROGRAPH ROUTING

ROUTE THROUGH GANOGA LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPHAT
1	0	0	0.000	0.000	0.000	374.	-1

STAGE	2266.00	2267.00	2268.00	2268.70	2269.00	2269.50	2270.00	2270.50	2271.00
	2273.00								
FLOW	0.00	40.00	110.00	180.00	370.00	890.00	1860.00	2940.00	4010.00
	11290.00								
CAPACITY=	0.	374.	456.	542.	604.	632.	727.	826.	1039.
ELEVATION=	2244.	2266.	2267.	2268.	2269.	2269.	2270.	2271.	2273.

CREL	SPWID	COON	EXPW	ELEVL	COOL	CAREA	EXPL
2266.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
2268.7	0.0	0.0	0.

PEAK OUTFLOW IS 638. AT TIME 43.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	638.	423.	189.	70.	20281.
CMS	18.	12.	5.	2.	574.
INCHES		4.92	8.79	9.83	9.83
MM		124.93	223.22	249.58	249.58
AC-FT		210.	375.	419.	419.
THOUS CU M		259.	462.	517.	517.

GANOGA LAKE
OUTFLOW HYDROGRAPHS.

0.5PMF

PEAK OUTFLOW IS 1176. AT TIME 42.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1176.	748.	284.	103.	29713.
CMS	33.	21.	8.	3.	841.
INCHES		8.70	13.19	14.40	14.40
MM		220.98	334.93	365.66	365.66
AC-FT		371.	562.	614.	614.
THOUS CU M		458.	694.	757.	757.

0.7PMF

PEAK OUTFLOW IS 1916. AT TIME 42.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1916.	1233.	427.	152.	43893.
CMS	54.	35.	12.	4.	1243.
INCHES		14.34	19.84	21.27	21.27
MM		364.14	503.93	540.15	540.15
AC-FT		611.	846.	907.	907.
THOUS CU M		754.	1044.	1119.	1119.

PMF

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SUB-AREA RUNOFF COMPUTATION

LAKE JEAN INFLOW COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.20	0.00	3.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.20	116.00	126.00	135.00	141.00	144.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.85 CP= .50 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.01 AND R=10.12 INTERVALS

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY RJS DATE 6-9-80 PROJ. NO. 79-223-570
CHKD. BY DLB DATE 6-9-80 SHEET NO. C OF J

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UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 1.85 HOURS, CP= .50 VOL= 1.00

17.	62.	126.	201.	275.	336.	376.	386.	367.	332.
301.	273.	247.	224.	203.	184.	166.	151.	137.	124.
112.	101.	92.	83.	75.	68.	62.	56.	51.	46.
42.	38.	34.	31.	28.	25.	23.	21.	19.	17.
16.	14.	13.	12.	10.	9.	9.	8.	7.	6.
6.	5.	5.	4.	4.	4.	3.	3.		

END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.57	22.95	2.62	131277.
										(650.)	(583.)	(67.)	(3717.35)

LOCAL INFLOW HYDROGRAPHS, LAKE JEAN.

0.5PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2571.	1869.	666.	228.	65638.
CMS	73.	52.	19.	6.	1859.
INCHES		7.81	11.27	11.56	11.56
MM		198.43	286.16	293.73	293.73
AC-FT		916.	1321.	1356.	1356.
THOUS CU M		1130.	1630.	1673.	1673.

0.7 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3600.	2587.	933.	319.	91893.
CMS	102.	73.	26.	9.	2602.
INCHES		10.94	15.77	16.19	16.19
MM		277.81	400.62	411.22	411.22
AC-FT		1283.	1850.	1899.	1899.
THOUS CU M		1582.	2282.	2342.	2342.

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5143.	3695.	1332.	456.	131275.
CMS	146.	105.	38.	13.	3717.
INCHES		15.62	22.53	23.13	23.13
MM		396.87	572.32	587.45	587.45
AC-FT		1832.	2642.	2712.	2712.
THOUS CU M		2260.	3259.	3346.	3346.

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COMBINE HYDROGRAPHS

COMBINE GANOGA LAKE OUTFLOW HYDROGRAPH WITH LAKE JEAN INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	2	0	0	0	0	1	0	0

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY [illegible] DATE 6-9-80 PROJ. NO. 79-203-570
CHKD. BY Dab DATE 6-9-80 SHEET NO. D OF J

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SUM OF LAKE JEAN LOCAL INFLOW HYDROGRAPH AND GANOGA LAKE OUTFLOW HYDROGRAPH.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2869.	2203.	834.	298.	85918.
CMS	81.	62.	24.	8.	2433.
INCHES		6.83	10.35	11.10	11.10
MM		173.52	262.86	281.95	281.95
AC-FT		1092.	1655.	1775.	1775.
THOUS CU M		1348.	2041.	2190.	2190.

0.5PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4554.	3263.	1195.	422.	121606.
CMS	129.	92.	34.	12.	3443.
INCHES		10.12	14.82	15.71	15.71
MM		256.98	376.37	399.07	399.07
AC-FT		1618.	2370.	2513.	2513.
THOUS CU M		1996.	2923.	3099.	3099.

0.7PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6998.	4862.	1737.	608.	175168.
CMS	198.	138.	49.	17.	4960.
INCHES		15.08	21.55	22.63	22.63
MM		382.95	547.25	574.84	574.84
AC-FT		2411.	3445.	3619.	3619.
THOUS CU M		2974.	4250.	4464.	4464.

PMF

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HYDROGRAPH ROUTING

ROUTE TOTAL HYDROGRAPH THROUGH LAKE JEAN

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
202	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	1400.	-1

STAGE	2220.00	2221.00	2222.00	2223.00	2224.00	2225.00	2226.00	2227.00	2228.00
	2229.00	2229.20	2229.50	2230.00	2230.50	2231.00			
FLOW	0.00	60.00	170.00	310.00	480.00	670.00	880.00	1110.00	3000.00
	9690.00	11600.00	14690.00	21070.00	28430.00	37140.00			
CAPACITY=	0.	1400.	2750.	3370.	3690.	3990.	4370.	4720.	5080.	5460.
ELEVATION=	2203.	2220.	2225.	2227.	2228.	2229.	2230.	2231.	2232.	2233.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
2220.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
2228.9	0.0	0.0	0.

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY RJS DATE 6-9-80 PROJ. NO. 79-203-570
CHKD. BY DLB DATE 6-9-80 SHEET NO. E OF J

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM

BY DJS DATE 6-9-80 PROJ. NO. 79-203-570

CHKD. BY DLB DATE 6-9-80 SHEET NO. F OF J

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LAKE JEAN OUTFLOW HYDROGRAPHS.

0.5PMF

PEAK OUTFLOW IS 582. AT TIME 47.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	582.	568.	456.	181.	52075.
CMS	16.	16.	13.	5.	1475.
INCHES		1.76	5.65	6.73	6.73
MM		44.77	143.62	170.89	170.89
AC-FT		282.	904.	1076.	1076.
THOUS CU M		348.	1115.	1327.	1327.

0.7PMF

PEAK OUTFLOW IS 934. AT TIME 47.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	934.	908.	709.	278.	80063.
CMS	26.	26.	20.	8.	2267.
INCHES		2.82	8.79	10.34	10.34
MM		71.53	223.23	262.74	262.74
AC-FT		450.	1405.	1654.	1654.
THOUS CU M		556.	1734.	2040.	2040.

PMF

PEAK OUTFLOW IS 2737. AT TIME 45.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2737.	2187.	1173.	446.	128385.
CMS	78.	62.	33.	13.	3635.
INCHES		6.78	14.55	16.59	16.59
MM		172.21	369.60	421.31	421.31
AC-FT		1084.	2327.	2653.	2653.
THOUS CU M		1337.	2870.	3272.	3272.

STAGE - HYDROGRAPH FOR PMF EVENT; EAST DIKE (ELEV 2227.0) OVERTOPPED FOR ≈ 7.25 HOURS.

STAGE

2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0	2220.0
2220.0	2220.0	2220.0	2220.0	2220.1	2220.1	2220.1	2220.1	2220.1	2220.1
2220.1	2220.1	2220.1	2220.1	2220.1	2220.1	2220.1	2220.1	2220.2	2220.2
2220.2	2220.2	2220.2	2220.2	2220.3	2220.3	2220.3	2220.3	2220.3	2220.4
2220.4	2220.4	2220.4	2220.4	2220.5	2220.5	2220.5	2220.6	2220.6	2220.7
2220.7	2220.8	2220.9	2221.0	2221.1	2221.3	2221.4	2221.6	2221.8	2222.0
2222.3	2222.6	2222.9	2223.3	2223.8	2224.3	2224.8	2225.2	2225.6	2226.0
2226.4	2226.7	2227.0	2227.3	2227.5	2227.6	2227.7	2227.8	2227.8	2227.9
2227.9	2227.9	2227.8	2227.8	2227.8	2227.7	2227.7	2227.6	2227.6	2227.5
2227.4	2227.4	2227.3	2227.3	2227.2	2227.2	2227.2	2227.1	2227.1	2227.0
2227.0	2226.9	2226.9	2226.9	2226.8	2226.8	2226.7	2226.7	2226.6	2226.6
2226.5	2226.5	2226.5	2226.4	2226.4	2226.3	2226.3	2226.2	2226.2	2226.1
2226.1	2226.0	2226.0	2225.9	2225.9	2225.8	2225.8	2225.8	2225.7	2225.7
2225.6	2225.6	2225.5	2225.5	2225.5	2225.4	2225.4	2225.3	2225.3	2225.2
2225.2	2225.2	2225.1	2225.1	2225.0	2225.0	2225.0	2224.9	2224.9	2224.8
2224.8	2224.8	2224.7	2224.7	2224.6	2224.6	2224.6	2224.5	2224.5	2224.4
2224.4	2224.4	2224.3	2224.3	2224.3	2224.3	2224.2	2224.2	2224.2	2224.1
2224.1	2224.1	2224.0	2224.0	2224.0	2223.9	2223.9	2223.9	2223.8	2223.8
2223.8	2223.8	2223.7	2223.7	2223.7	2223.6	2223.6	2223.6		

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .60	RATIO 3 .70	RATIO 4 1.00
HYDROGRAPH AT	1	.80	1	1110.	1332.	1554.	2220.
	(	2.07)	(	31.43)(	37.72)(	44.01)(	62.87)(
ROUTED TO	101	.80	1	638.	877.	1176.	1916.
	(	2.07)	(	18.05)(	24.82)(	33.31)(	54.27)(
HYDROGRAPH AT	2	2.20	1	2571.	3086.	3600.	5143.
	(	5.70)	(	72.82)(	87.38)(	101.94)(	145.63)(
2 COMBINED	2	3.00	1	2869.	3694.	4554.	6998.
	(	7.77)	(	81.25)(	104.60)(	128.96)(	198.17)(
ROUTED TO	202	3.00	1	582.	758.	934.	2737.
	(	7.77)	(	16.47)(	21.46)(	26.45)(	77.51)(

SUMMARY:

GANOGA LAKE.

LAKE JEAN.

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2266.00	2266.00	2268.70
STORAGE	374.	374.	604.
OUTFLOW	0.	0.	180.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	2269.26	.56	656.	638.	6.25	43.25	0.00
.60	2269.49	.79	678.	877.	7.25	43.00	0.00
.70	2269.65	.95	694.	1176.	8.00	42.50	0.00
1.00	2270.03	1.33	730.	1916.	9.50	42.00	0.00

GANOGA LAKE.

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2220.00	2220.00	2228.90
STORAGE	1400.	1400.	3990.
OUTFLOW	0.	0.	8800.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	2224.54	0.00	2625.	582.	0.00	47.75	0.00
.60	2225.42	0.00	2879.	758.	0.00	47.50	0.00
.70	2226.24	0.00	3133.	934.	0.00	47.25	0.00
.73 *	2227.00	—	3370.	1110.	—	—	—
1.00	2227.86	0.00	3646.	2737.	0.00	45.25	0.00

LAKE JEAN;
EAST DIKE
OVERTOPPED
@ ≃ 0.73 PMF.

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY BSS DATE 6-9-80 PROJ. NO. 79-203-570
CHKD. BY DAB DATE 6-9-80 SHEET NO. 6 OF 7

GAI CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

DAM SAFETY INSPECTION
LAKE JEAN DAM - OVERTOPPING ANALYSIS- EAST/WEST DIKES AT DESIGN ELEVATION
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

OVERTOPPING ANALYSIS (EAST & WEST DIKES AT DESIGN ELEVATION - 2229.0 ; INPUT SAME AS THAT FOR EXISTING CONDITIONS, EXCEPT FOR MODIFIED FACILITY RATING CURVE.)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TOTAL HYDROGRAPH THROUGH LAKE JEAN

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
202	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	1400.	-1

STAGE	2220.00	2221.00	2222.00	2223.00	2224.00	2225.00	2226.00	2227.00	2228.00
	2229.00	2229.20	2229.50	2230.00	2230.50	2231.00			
FLOW	0.00	60.00	170.00	310.00	480.00	670.00	880.00	1110.00	1210.00
	1470.00	2340.00	3870.00	8600.00	14930.00	21490.00			
CAPACITY=	0.	1400.	2750.	3370.	3690.	3990.	4370.	4720.	5080.	5460.
ELEVATION=	2203.	2220.	2225.	2227.	2228.	2229.	2230.	2231.	2232.	2233.

CWEL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
2220.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
2228.9	0.0	0.0	0.

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY DLB DATE 6-9-80 PROJ. NO. 79-203-570
CHKD. BY DLB DATE 6-9-80 SHEET NO. 11 OF 17

CONSULTANTS, INC.
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Environmental Specialists

SUBJECT DAM SAFETY INSPECTION

LAKE JEAN DAM

BY JJS DATE 6-9-80 PROJ. NO. 79-202-570

CHKD. BY DLS DATE 6-9-80 SHEET NO. I OF J

PEAK OUTFLOW IS 582. AT TIME 47.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	582.	568.	456.	181.	52075.
CMS	16.	16.	13.	5.	1475.
INCHES		1.76	5.65	6.73	6.73
MM		44.77	143.62	170.89	170.89
AC-FT		282.	904.	1076.	1076.
THOUS CU M		348.	1115.	1327.	1327.

0.5PMF

PEAK OUTFLOW IS 934. AT TIME 47.25 HOURS

LAKE JEAN
OUTFLOW
HYDROGRAPHS.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	934.	908.	709.	278.	80063.
CMS	26.	26.	20.	8.	2267.
INCHES		2.82	8.79	10.34	10.34
MM		71.53	223.23	262.74	262.74
AC-FT		450.	1405.	1654.	1654.
THOUS CU M		556.	1734.	2040.	2040.

0.7 PMF

PEAK OUTFLOW IS 1368. AT TIME 47.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1368.	1331.	1075.	423.	121755.
CMS	39.	38.	30.	12.	3448.
INCHES		4.13	13.33	15.73	15.73
MM		104.83	338.64	399.56	399.56
AC-FT		660.	2132.	2516.	2516.
THOUS CU M		814.	2630.	3103.	3103.

PMF

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .60	RATIO 3 .70	RATIO 4 1.00
HYDROGRAPH AT	1	.80	1	1110.	1332.	1554.	2220.
	(	2.07)	(	31.43)(	37.72)(	44.01)(	62.87)(
ROUTED TO	101	.80	1	638.	877.	1176.	1916.
	(	2.07)	(	18.05)(	24.82)(	33.31)(	54.27)(
HYDROGRAPH AT	2	2.20	1	2571.	3086.	3600.	5143.
	(	5.70)	(	72.82)(	87.38)(	101.94)(	145.63)(
2 COMBINED	2	3.00	1	2869.	3694.	4554.	6998.
	(	7.77)	(	81.25)(	104.60)(	128.96)(	198.17)(
ROUTED TO	202	3.00	1	582.	758.	934.	1368.
	(	7.77)	(	16.47)(	21.45)(	26.45)(	38.73)(

SUMMARY:

GANOGA LAKE.

LAKE JEAN.

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2266.00	2266.00	2268.70
STORAGE	374.	374.	604.
OUTFLOW	0.	0.	180.

GANOGA LAKE.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	2269.26	.56	656.	638.	6.25	43.25	0.00
.60	2269.49	.79	678.	877.	7.25	43.00	0.00
.70	2269.65	.95	694.	1176.	8.00	42.50	0.00
1.00	2270.03	1.33	730.	1916.	9.50	42.00	0.00

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2220.00	2220.00	2228.90
STORAGE	1400.	1400.	3990.
OUTFLOW	0.	0.	1420.

LAKE JEAN.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	2224.54	0.00	2625.	582.	0.00	47.75	0.00
.60	2225.42	0.00	2879.	758.	0.00	47.50	0.00
.70	2226.24	0.00	3133.	934.	0.00	47.25	0.00
1.00	2228.68	0.00	3916.	1368.	0.00	47.25	0.00

SUBJECT DAM SAFETY INSPECTION
LAKE JEAN DAM
BY JJS DATE 6-9-80
CHKD. BY DLB DATE 6-9-80
PROJ. NO. 79-303-570
SHEET NO. J OF J

CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

LIST OF REFERENCES

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APPENDIX E

FIGURES

LIST OF FIGURES

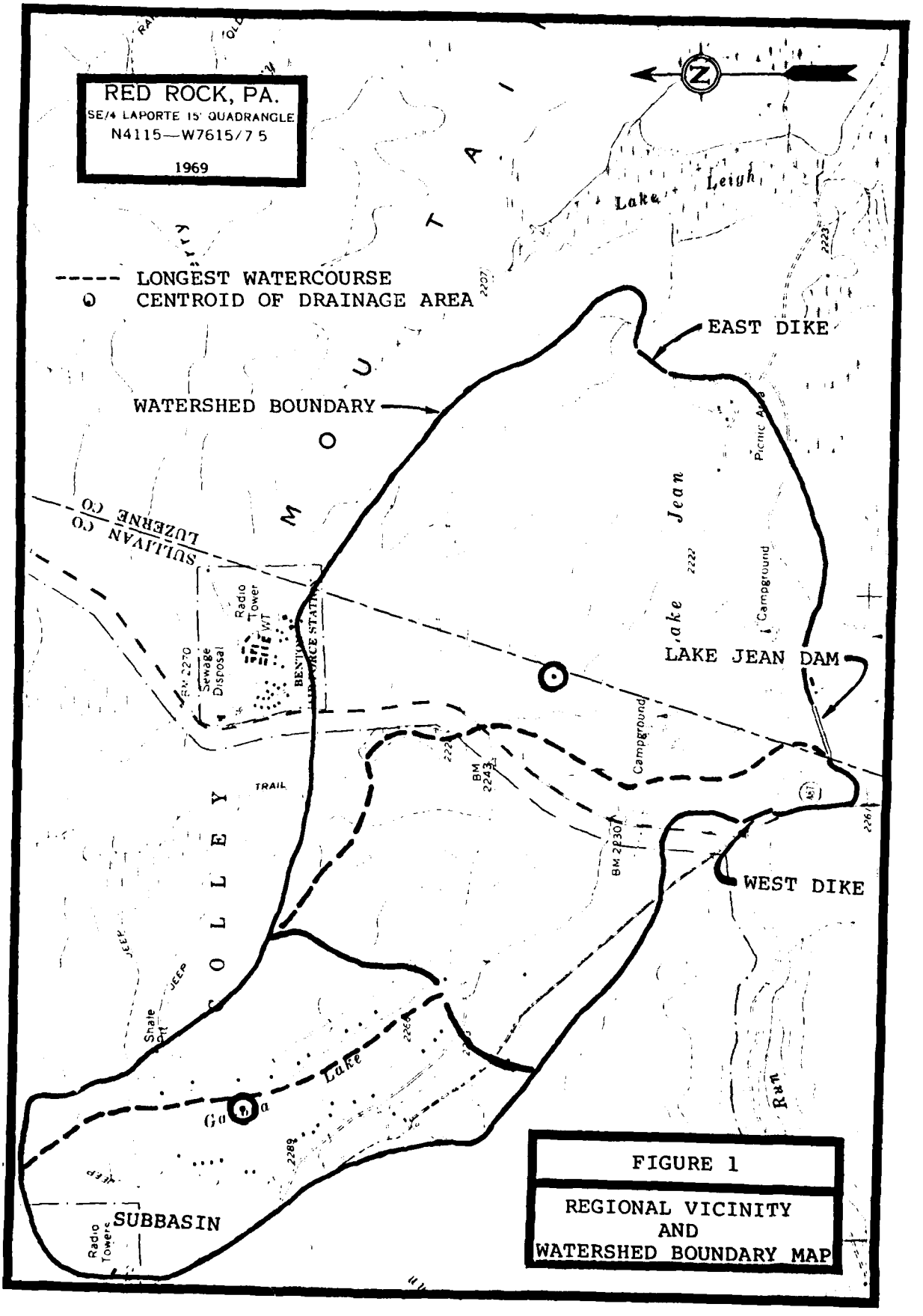
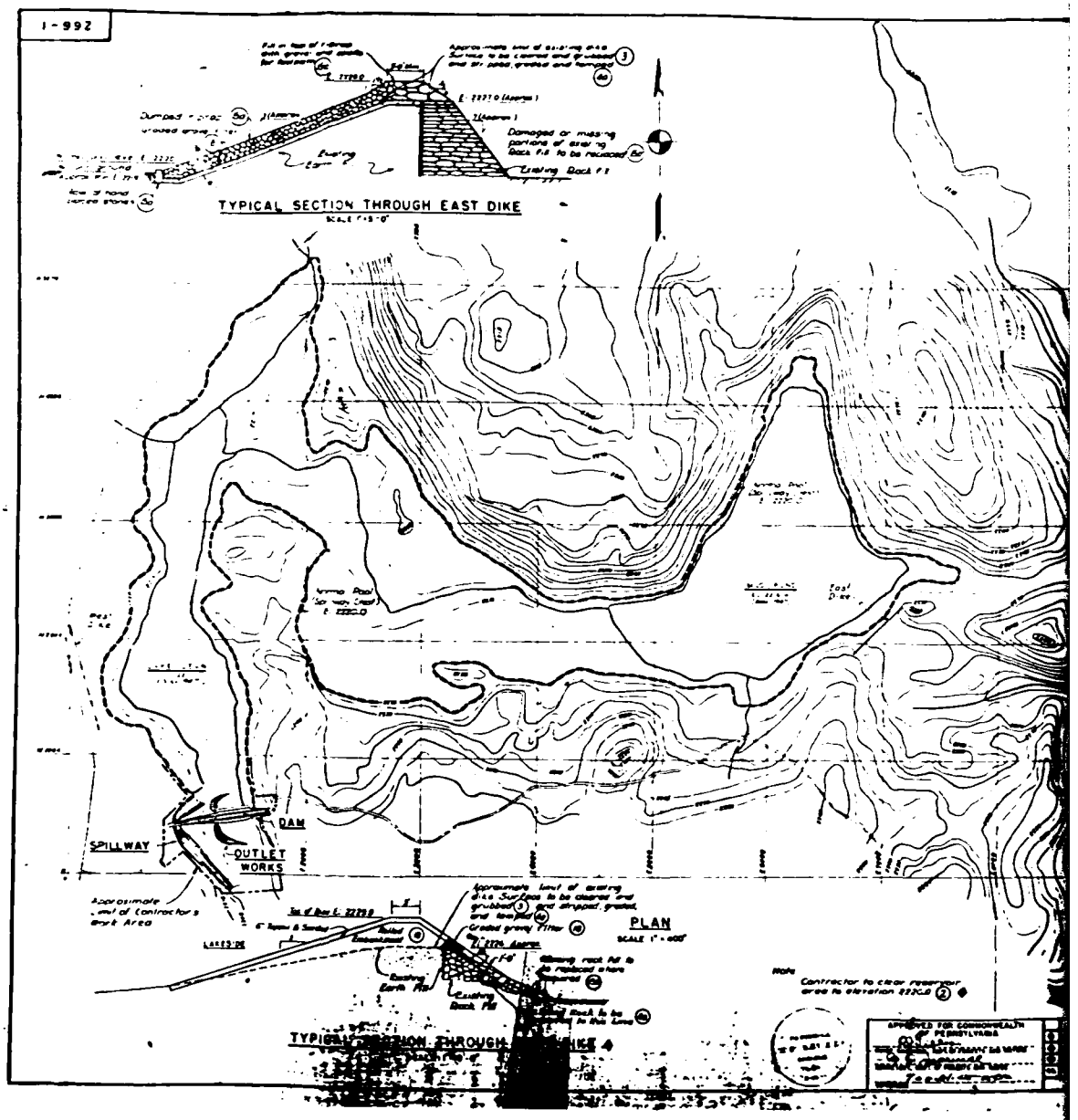
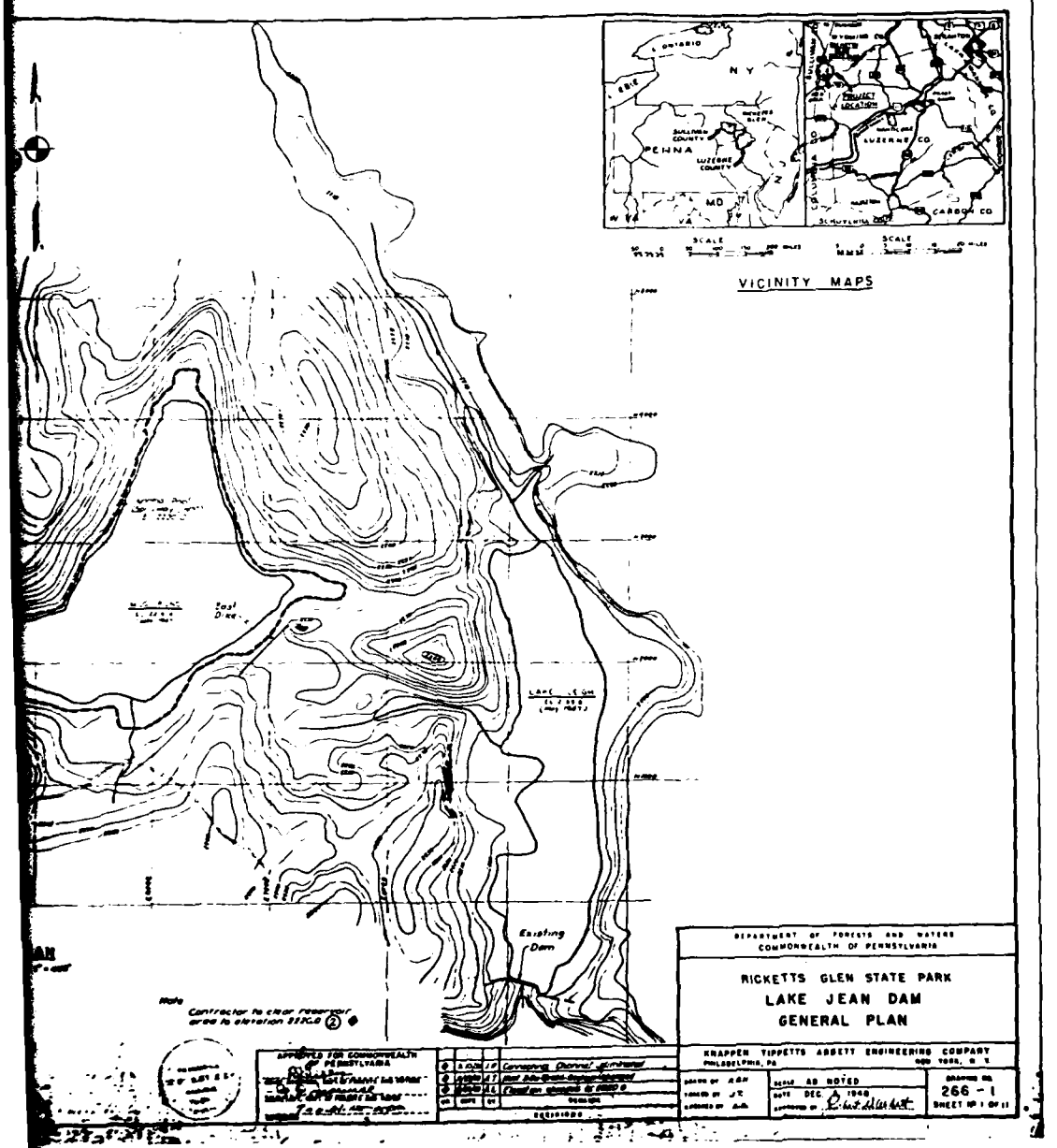


FIGURE 1

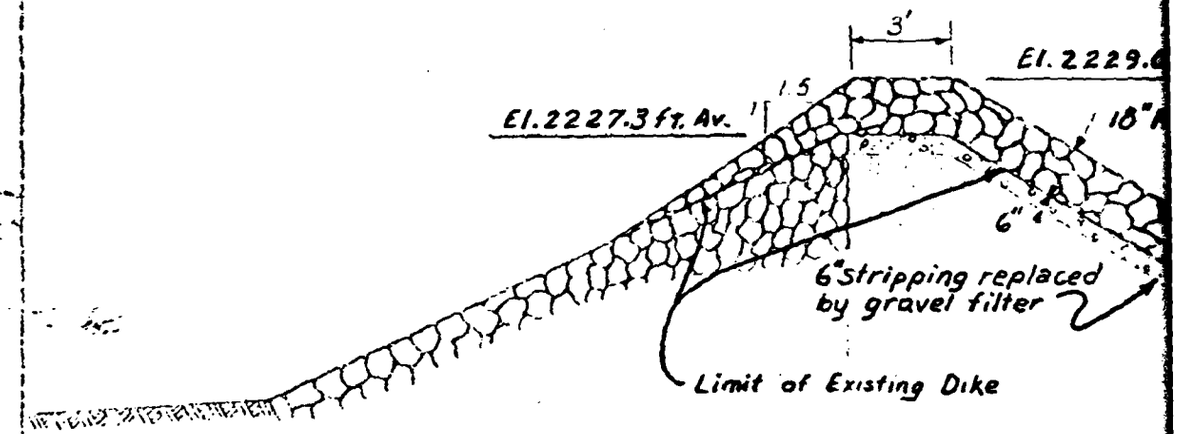
REGIONAL VICINITY AND WATERSHED BOUNDARY MAP


I-992
TYPICAL SECTION THROUGH EAST DIKE
DAM
SPILLWAY
OUTLET WORKS
PLAN
Note
Contractor to clear reservoir area to elevation 2270.0



gai CONSULTANTS, INC.

FIGURE 2



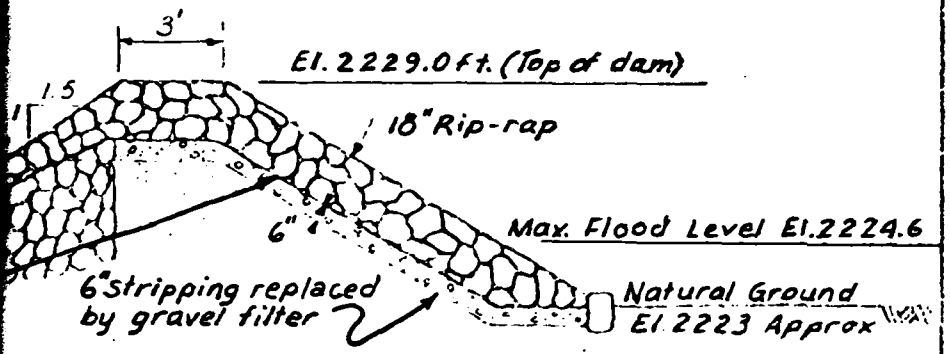
TYPICAL MAXIMUM SECTION

RIC

MOD

KNAPPEN

JAN 194



MAXIMUM SECTION

RICKETTS GLEN PROJECT

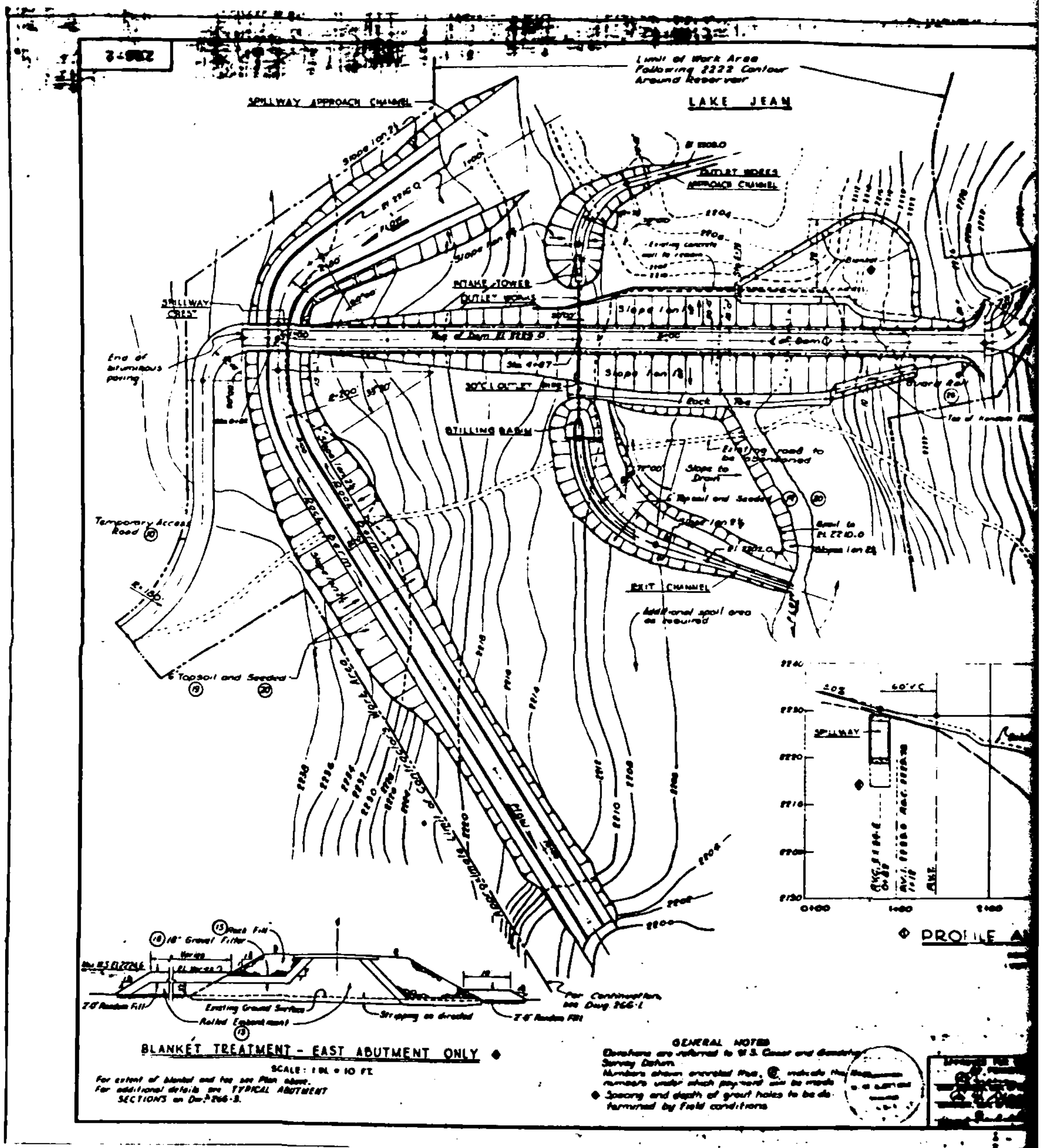
MODIFICATION OF EXISTING DIKE ON WEST SIDE OF LAKE JEAN

1" = 5'

KNAPPEN TIPPETTS ABBETT ENGINEERING CO.
JAN 1949 NEW YORK, N.Y.

GAI CONSULTANTS, INC.

FIGURE 3


Limit of Work Area Following 2222 Contour Around Reservoir
LAKE JEAN
SPILLWAY APPROACH CHANNEL
OUTLET WORKS APPROACH CHANNEL
INTAKE TOWER
SPILLWAY CREST
End of bituminous paving
STILLING BASIN
Temporary Access Road
EXIT CHANNEL
Additional spoil area as required
6" Topsoil and Seeded
SPILLWAY
PROFILE A
Rock Fill
18" Gravel Filter
Existing Ground Surface
Rolled Embankment
Stripping as directed
For Continuation, see Dwg 266-L
BLANKET TREATMENT - EAST ABUTMENT ONLY
SCALE: 1 IN. = 10 FT.
For extent of blanket and toe see Plan above.
For additional details see TYPICAL ABUTMENT SECTIONS on Dwg 266-3.
GENERAL NOTES
Spacing and depth of grout holes to be determined by field conditions

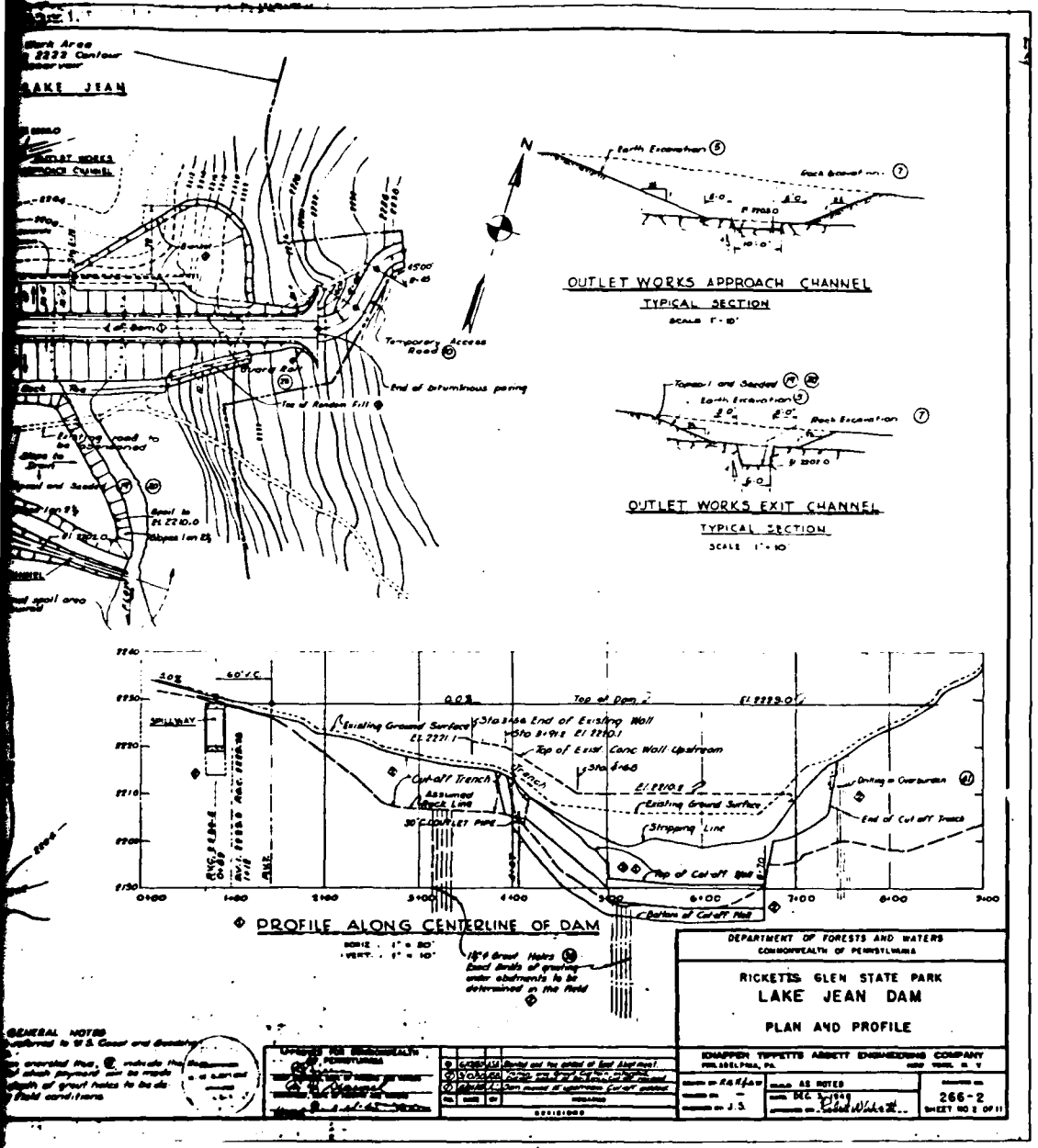


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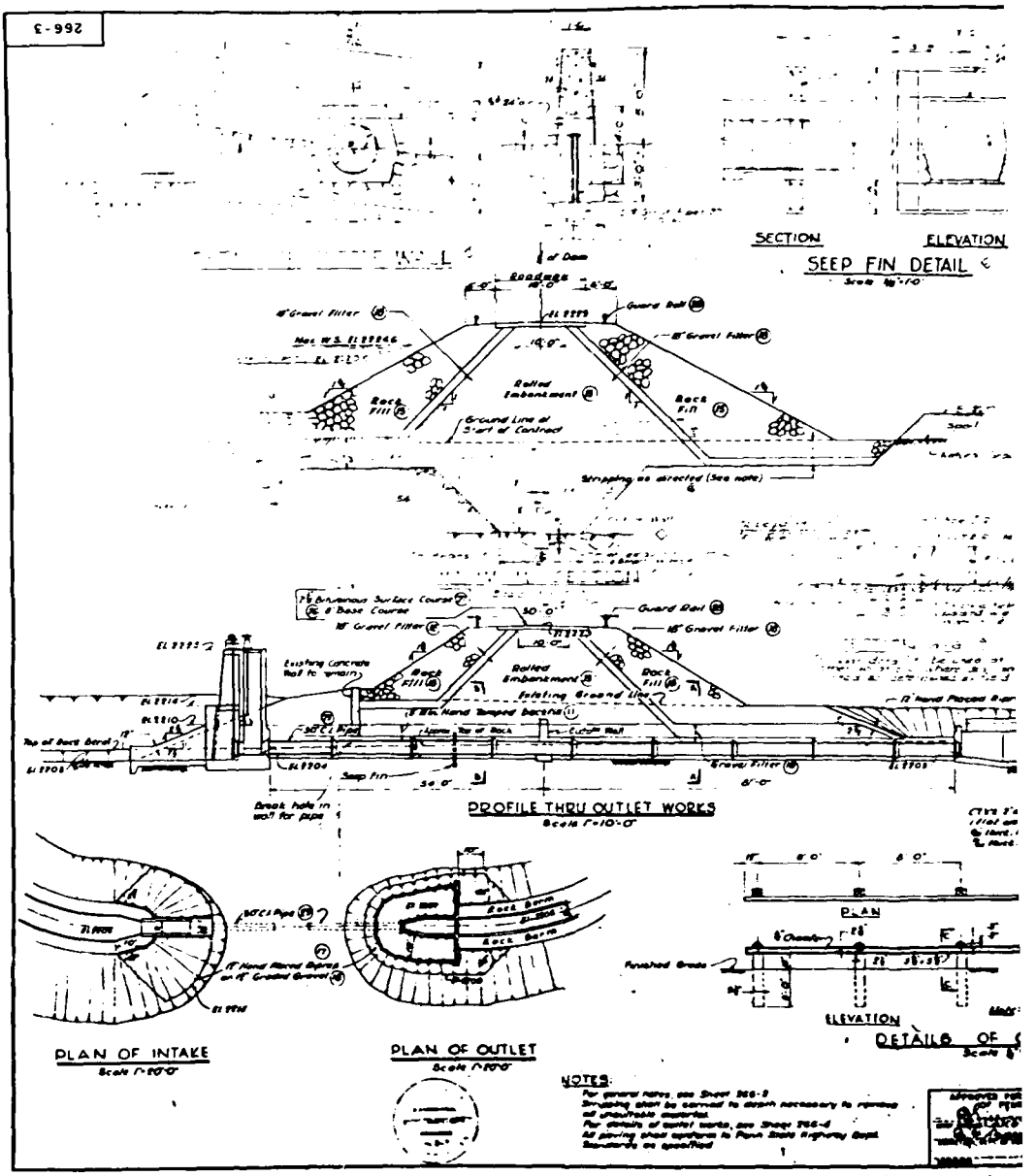
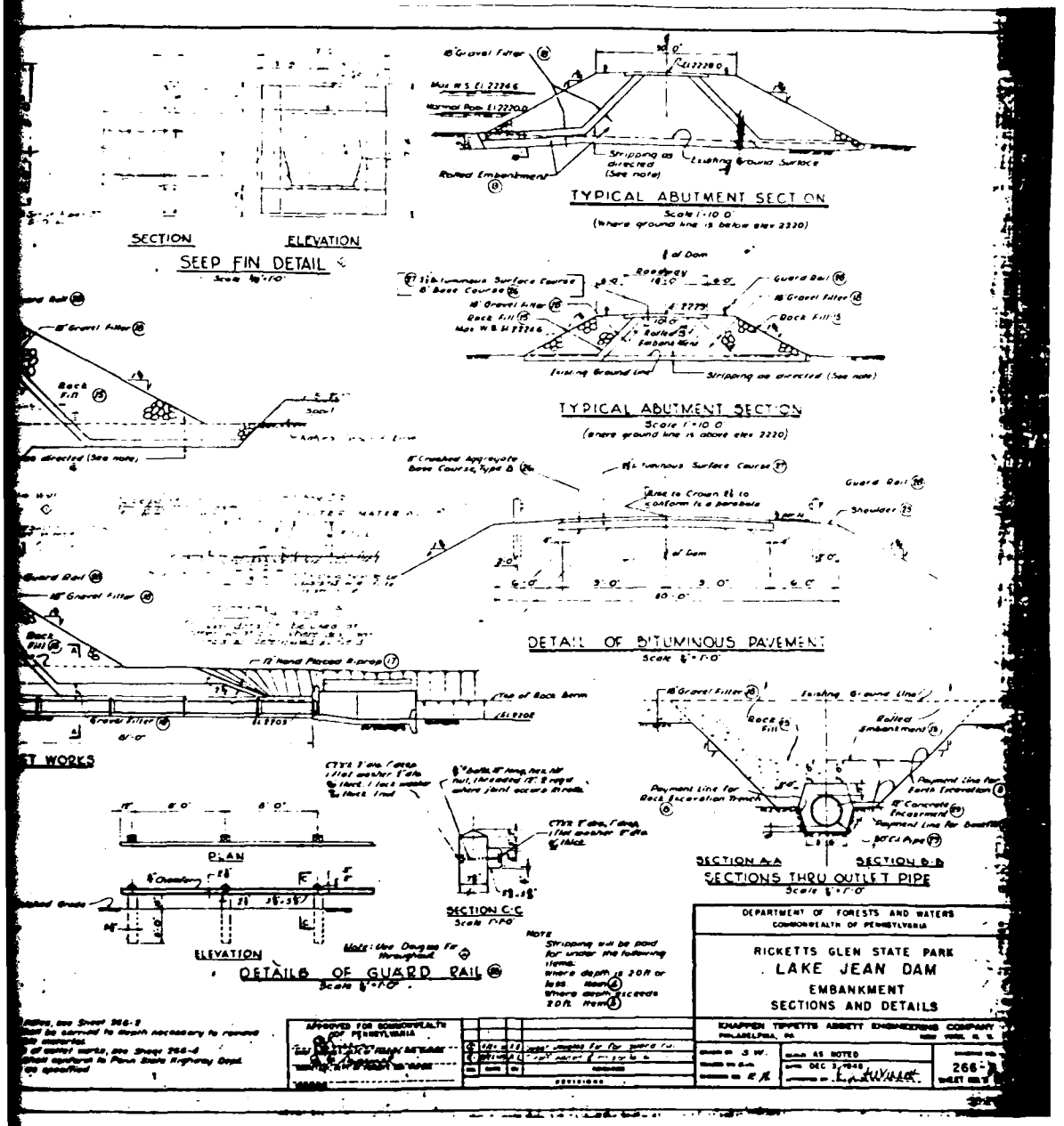
FIGURE 4


SECTION
ELEVATION
SEEP FIN DETAIL
Roadway
Guard Rail
Gravel Filter
Rolled Embankment
Rock Fill
Ground Line at Start of Contract
Stripping as directed (See note)
Existing Concrete Wall to remain
Existing Ground Line
Seep Fin
Break hole in wall for pipe
PROFILE THRU OUTLET WORKS
Scale 1"=10'-0"
PLAN OF INTAKE
Scale 1"=20'-0"
PLAN OF OUTLET
Scale 1"=10'-0"
PLAN
ELEVATION
DETAILS OF
NOTES:



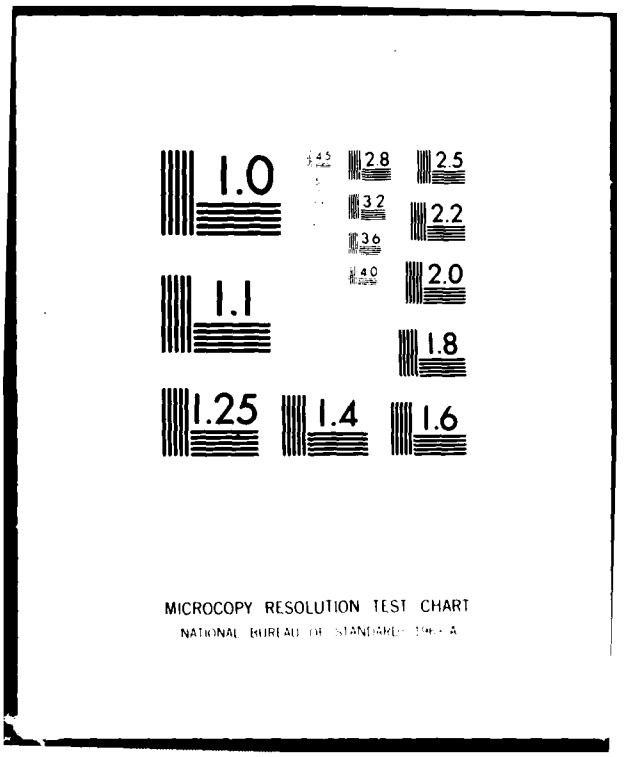
CONSULTAN

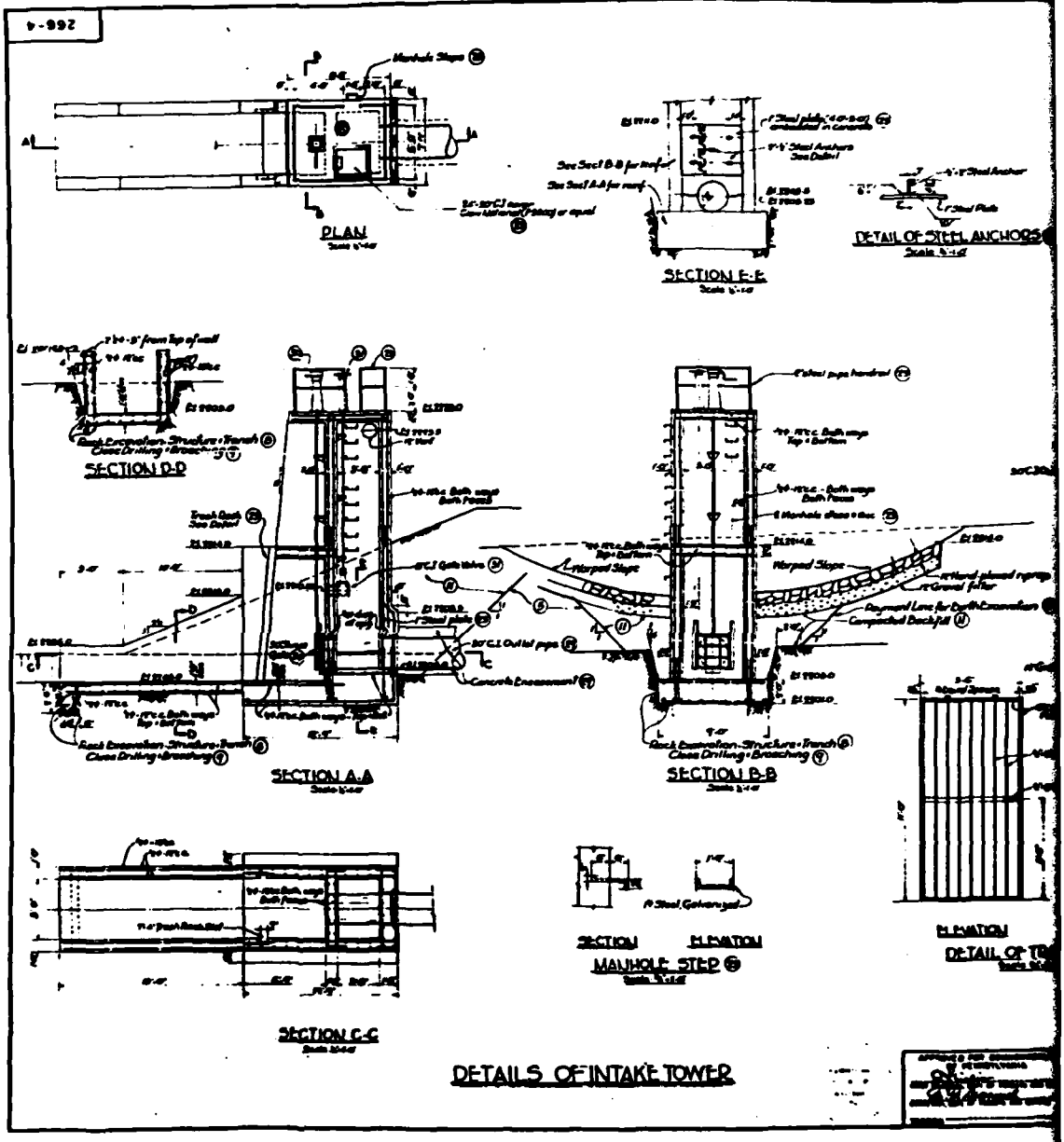
FIGURE

AD-A087 762 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. LAKE JEAN DAM, (NDI I.D. NUMBE--ETC(U)
JUL 80 B M MIHALCIN DACW31-80-C-0016

UNCLASSIFIED NL

END
DATE FILMED
9-80
DTIC


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A


PLAN
SECTION E-E
DETAIL OF STEEL ANCHORS
SECTION D-D
SECTION A-A
SECTION B-B
SECTION C-C
SECTION
ELEVATION
MANHOLE STEP
DETAILS OF INTAKE TOWER

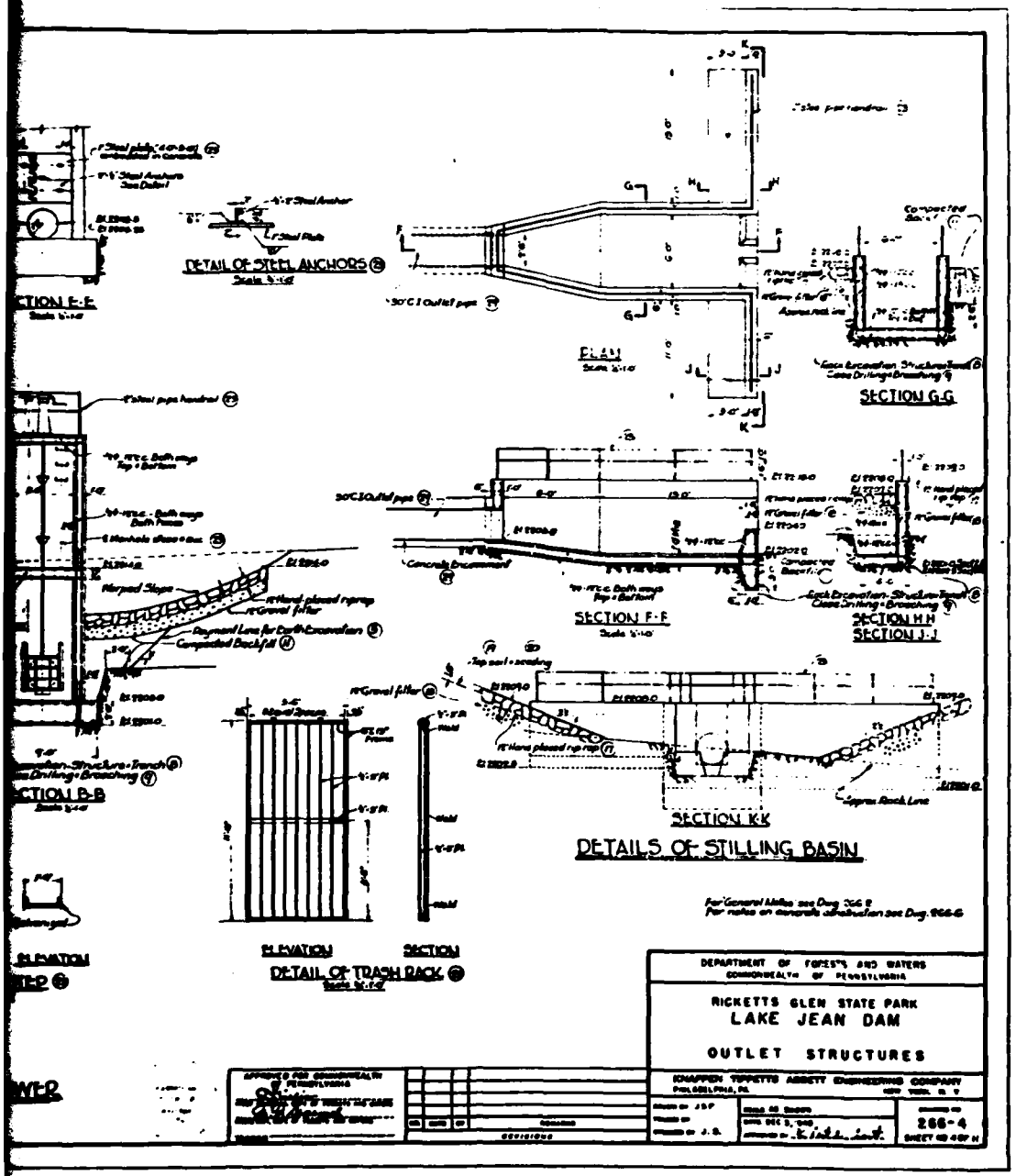


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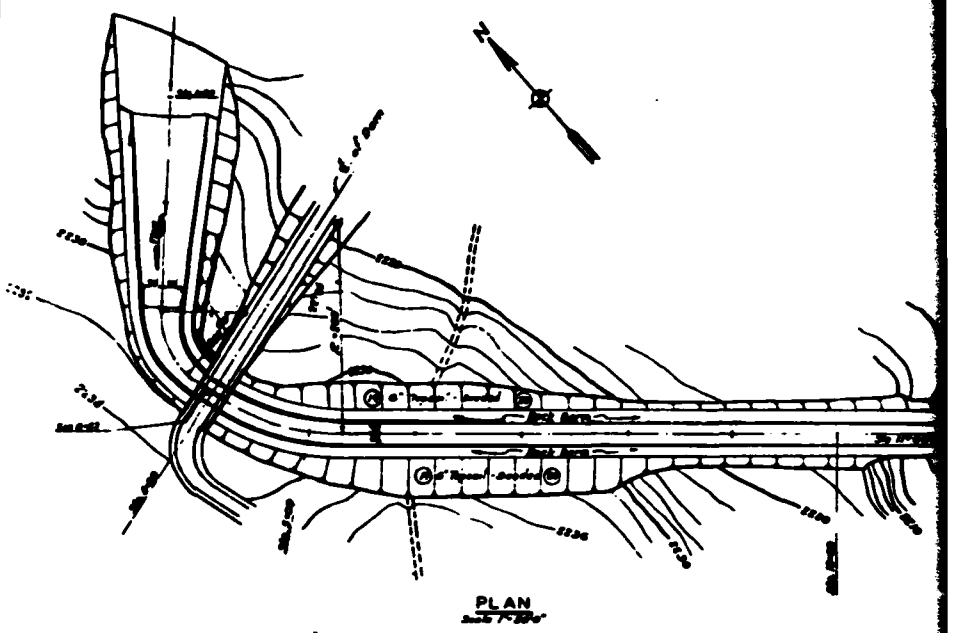
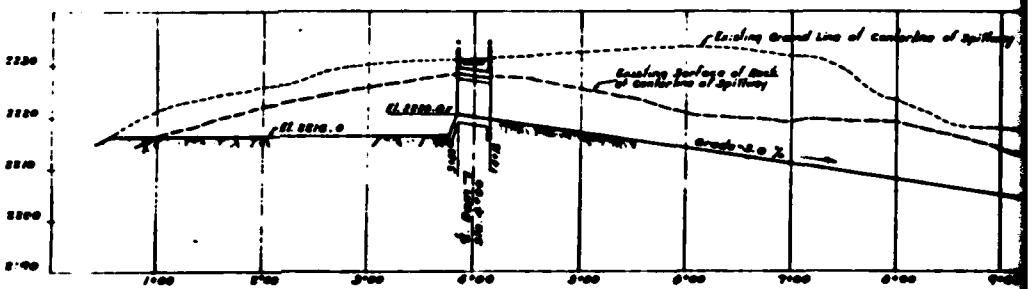
FIGURE 6

S-992



PLAN



PROFILE

NOTES

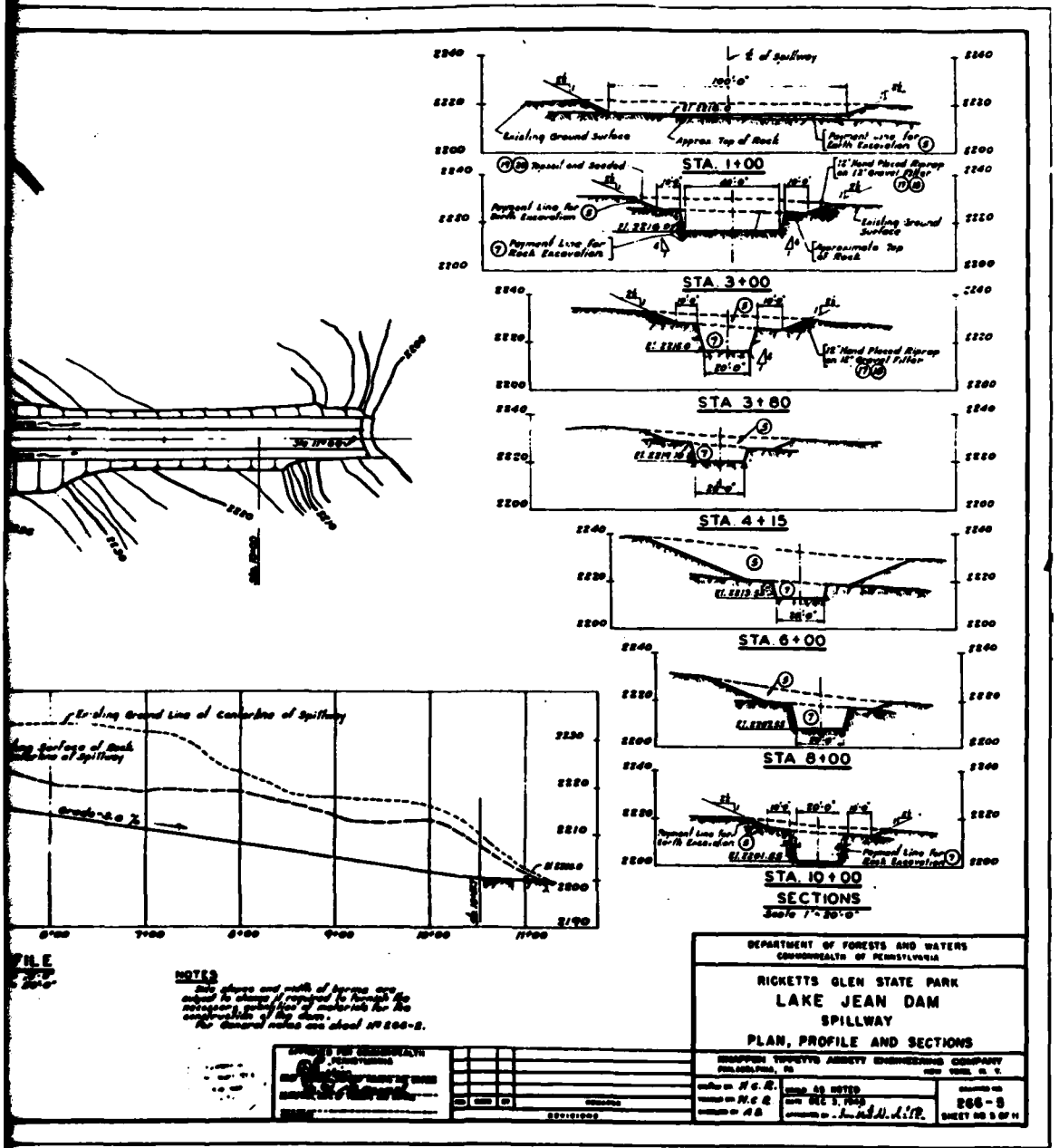


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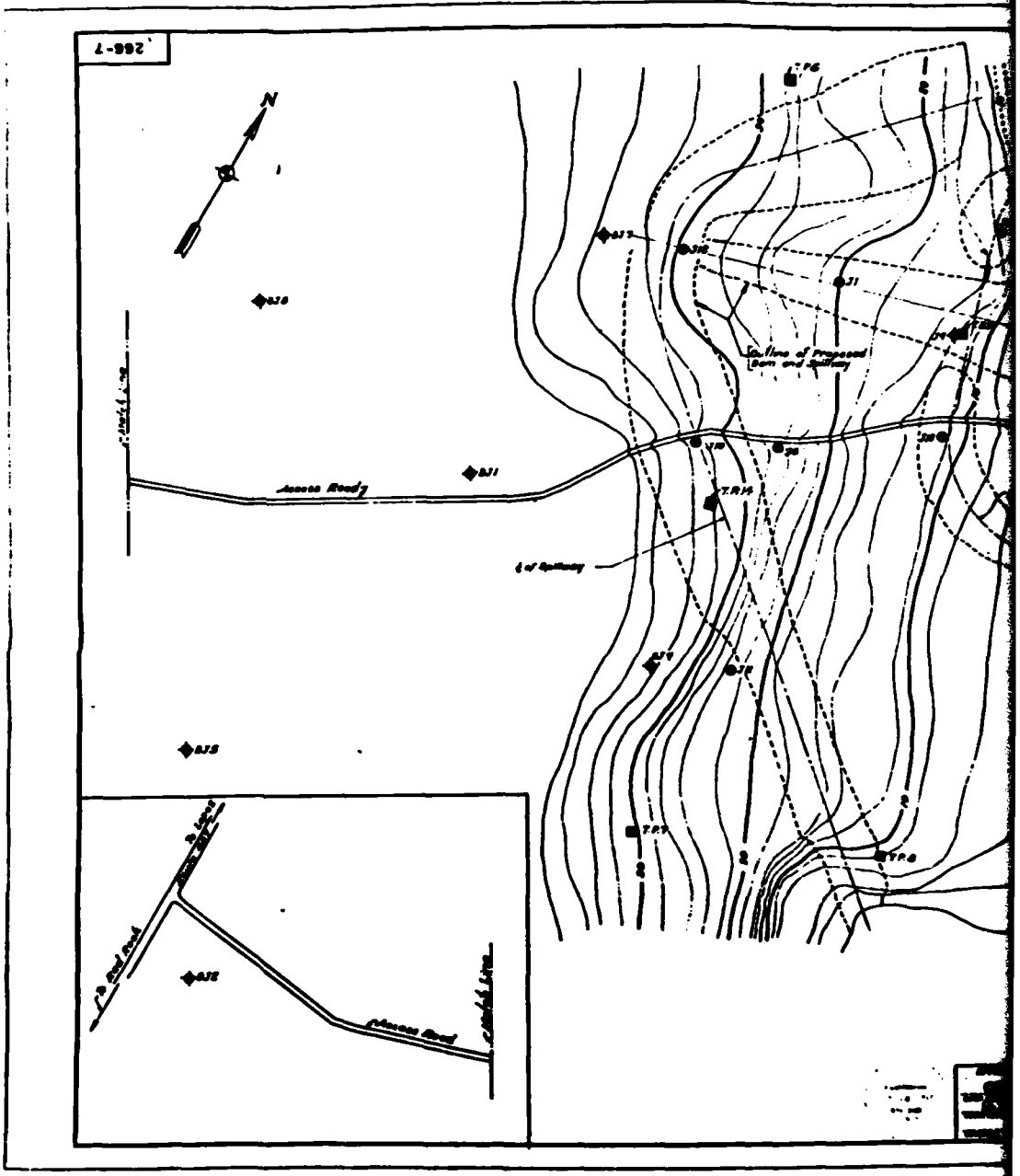
FIGURE 7


266-7
N
Access Road
Outline of Proposed Dam and Spillway
Left Spillway
Access Road

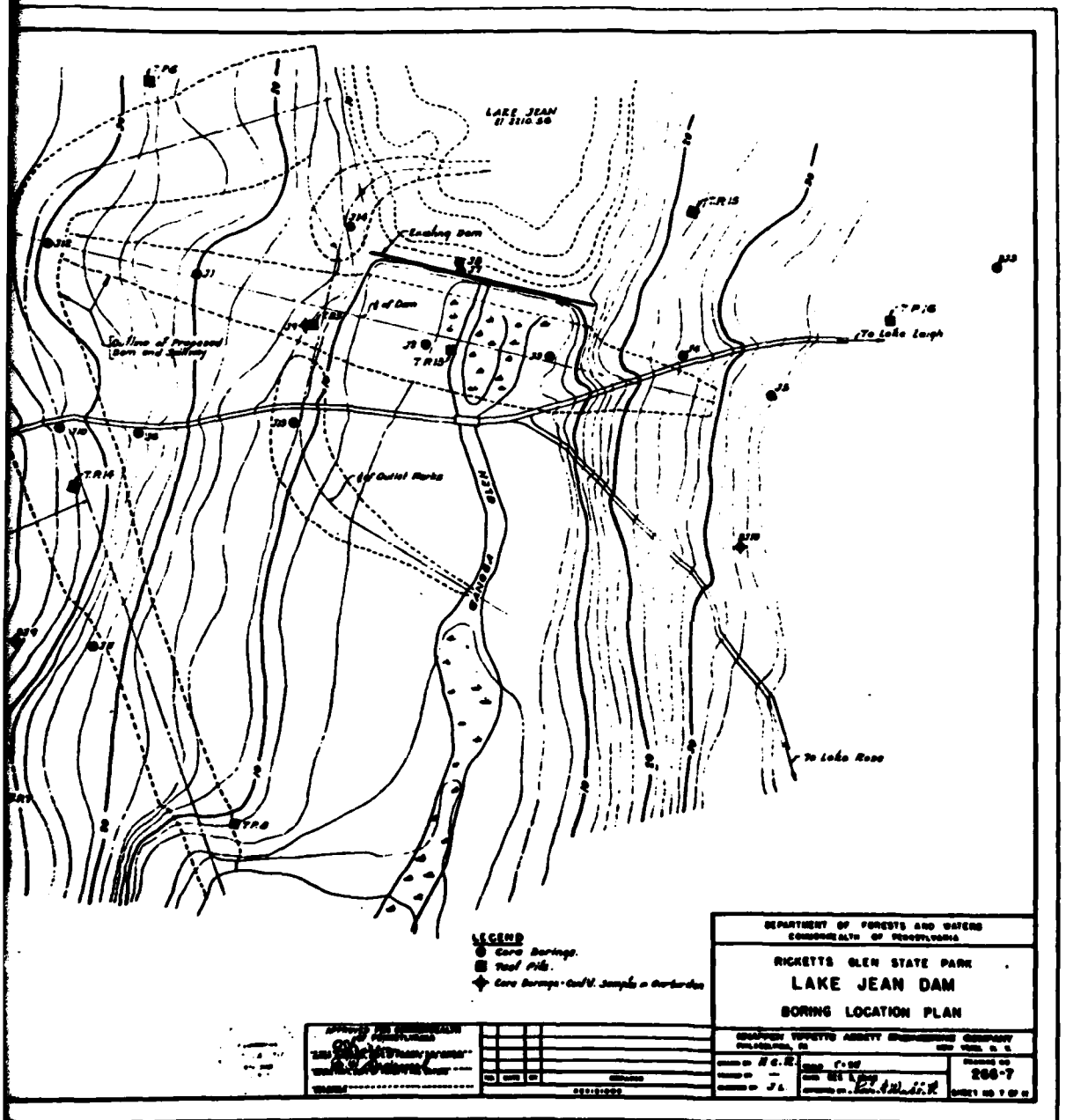


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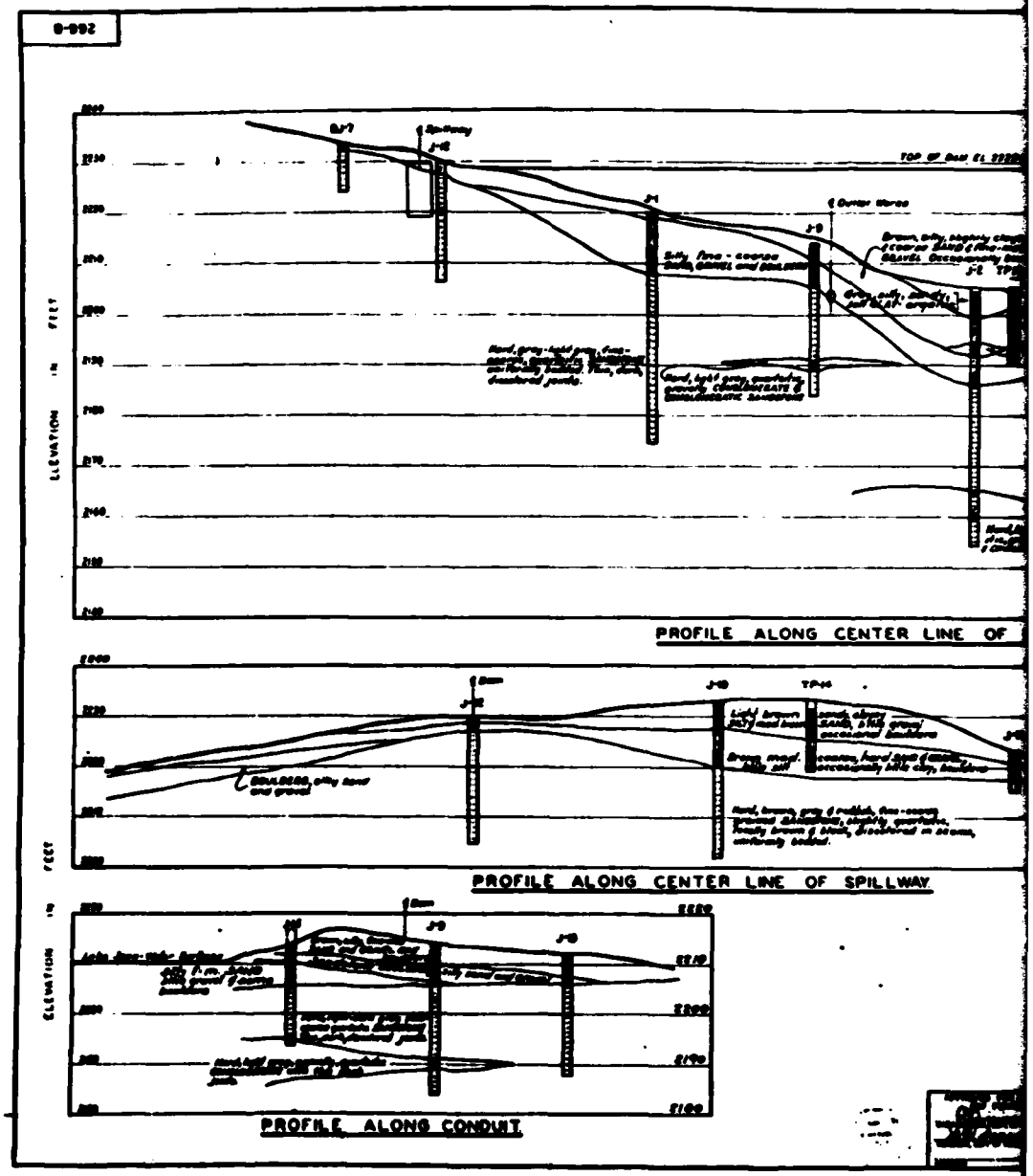
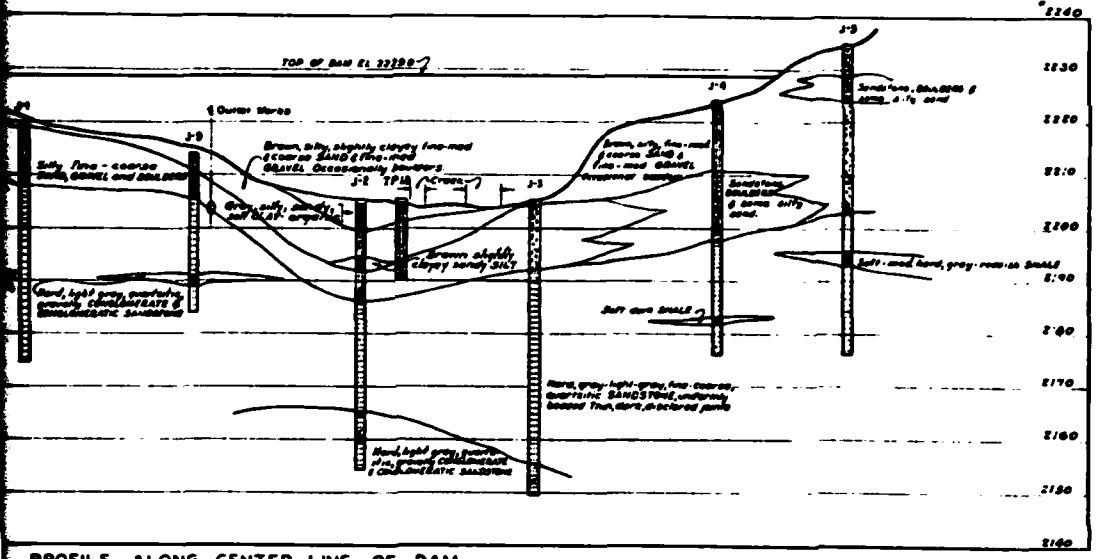
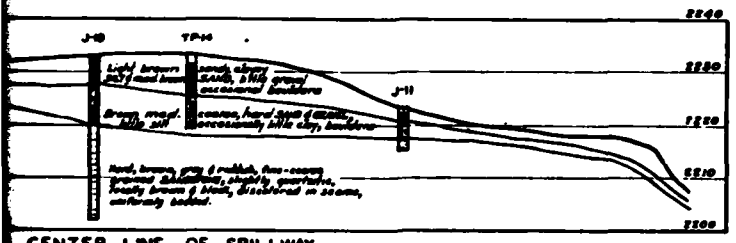
FIGURE 8


B-992
ELEVATION IN FEET
PROFILE ALONG CENTER LINE OF
PROFILE ALONG CENTER LINE OF SPILLWAY
PROFILE ALONG CONDUIT



PROFILE ALONG CENTER LINE OF DAM.



CENTER LINE OF SPILLWAY

DEPARTMENT OF FORESTS AND WATERS
COMMONWEALTH OF PENNSYLVANIA

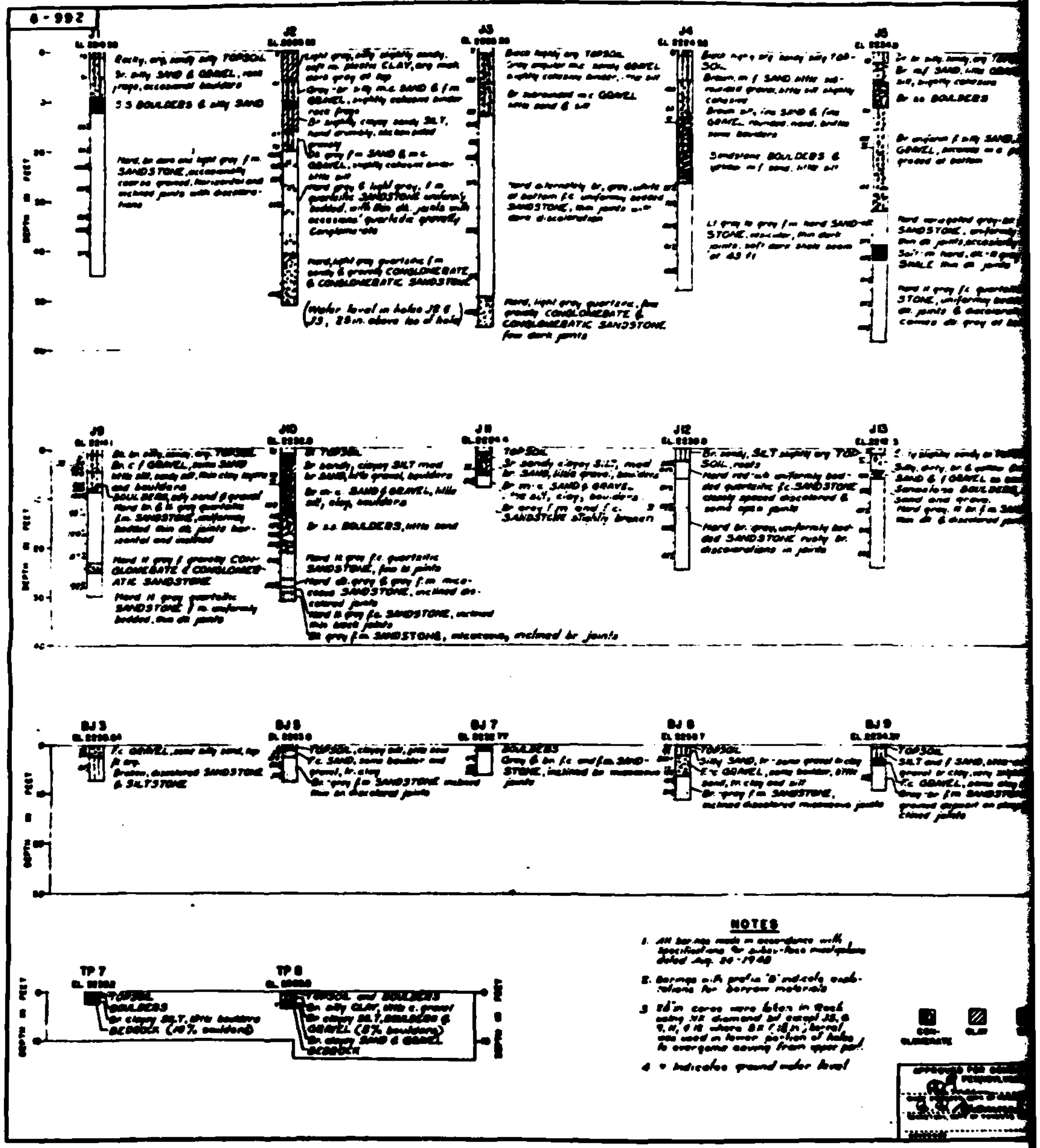
RICKETTS GLEN STATE PARK
LAKE JEAN DAM
GEOLOGIC PROFILES

KNAPPEN TIPPETTS ABBETT ENGINEERING COMPANY
PHILADELPHIA, PA. NEW YORK, N. Y.

DRAWN BY J.F.
CHECKED BY —
APPROVED BY G.F.
DATE DEC. 5, 1983
266 - 8

GAI CONSULTANTS, INC.

FIGURE 9


B-992
J1
J2
J3
J4
J5
J9
J10
J11
J12
J13
BJ 3
BJ 5
BJ 7
BJ 8
BJ 9
TP 7
TP 8
DEPTH IN FEET
NOTES

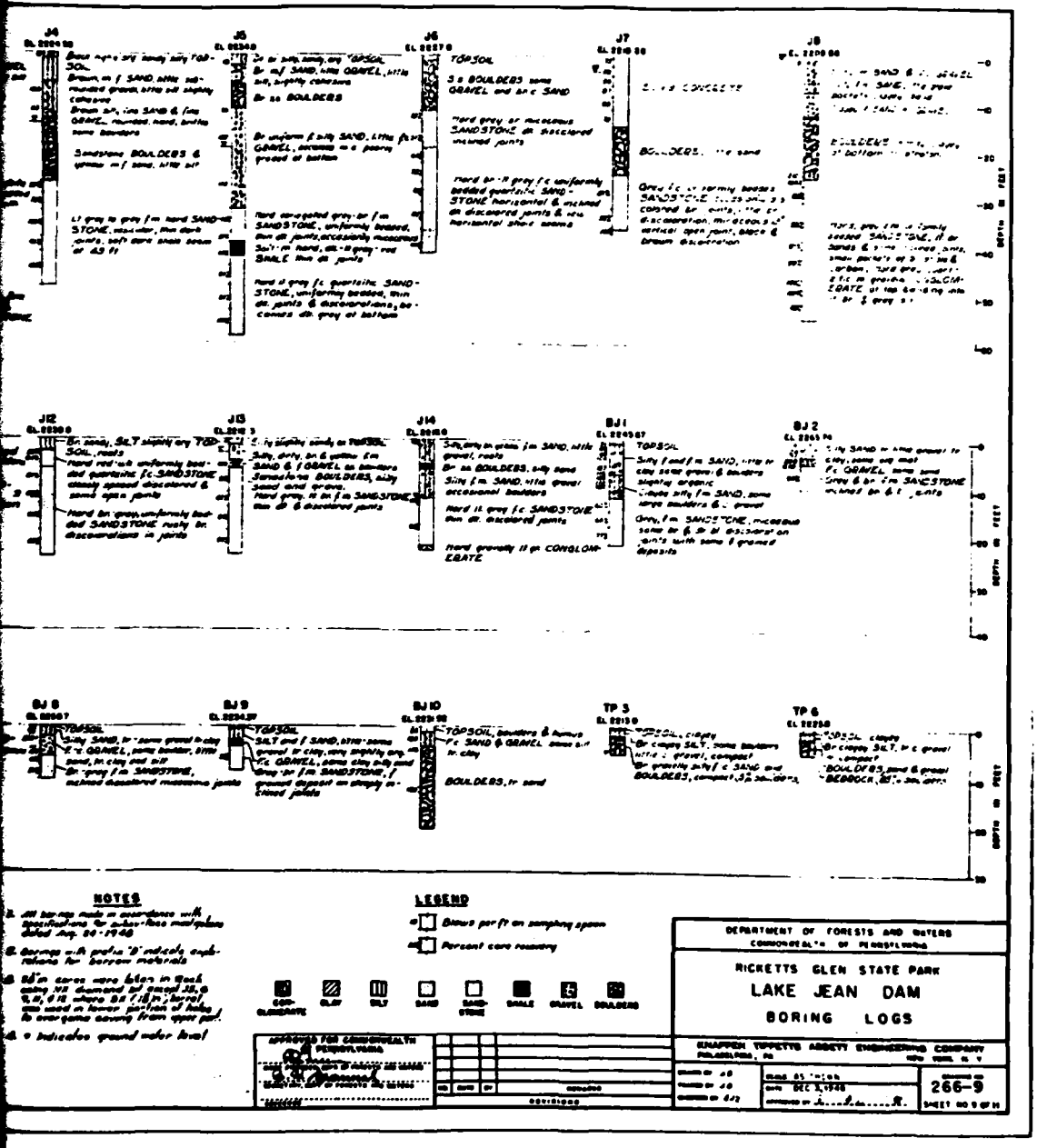


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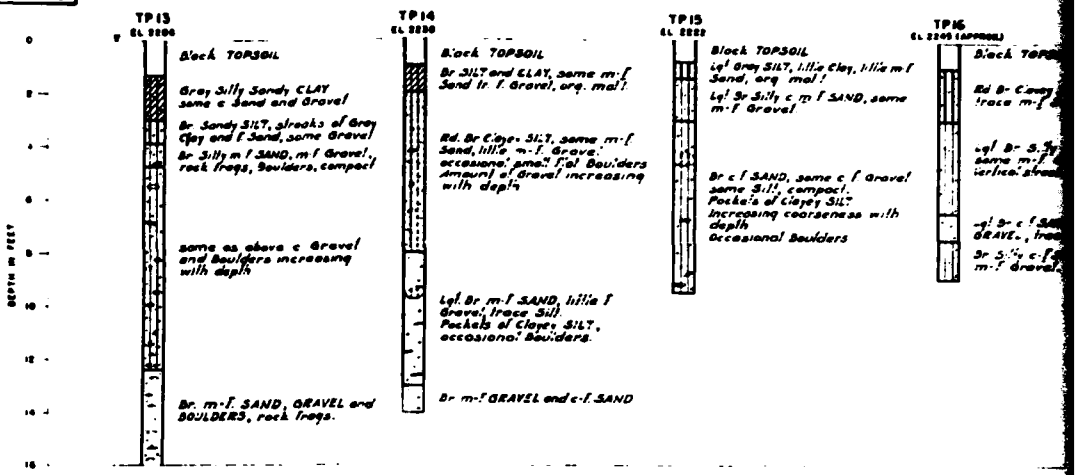
FIGURE 10

01 - 992



NOTES

1. ▽ Indicates ground water level.

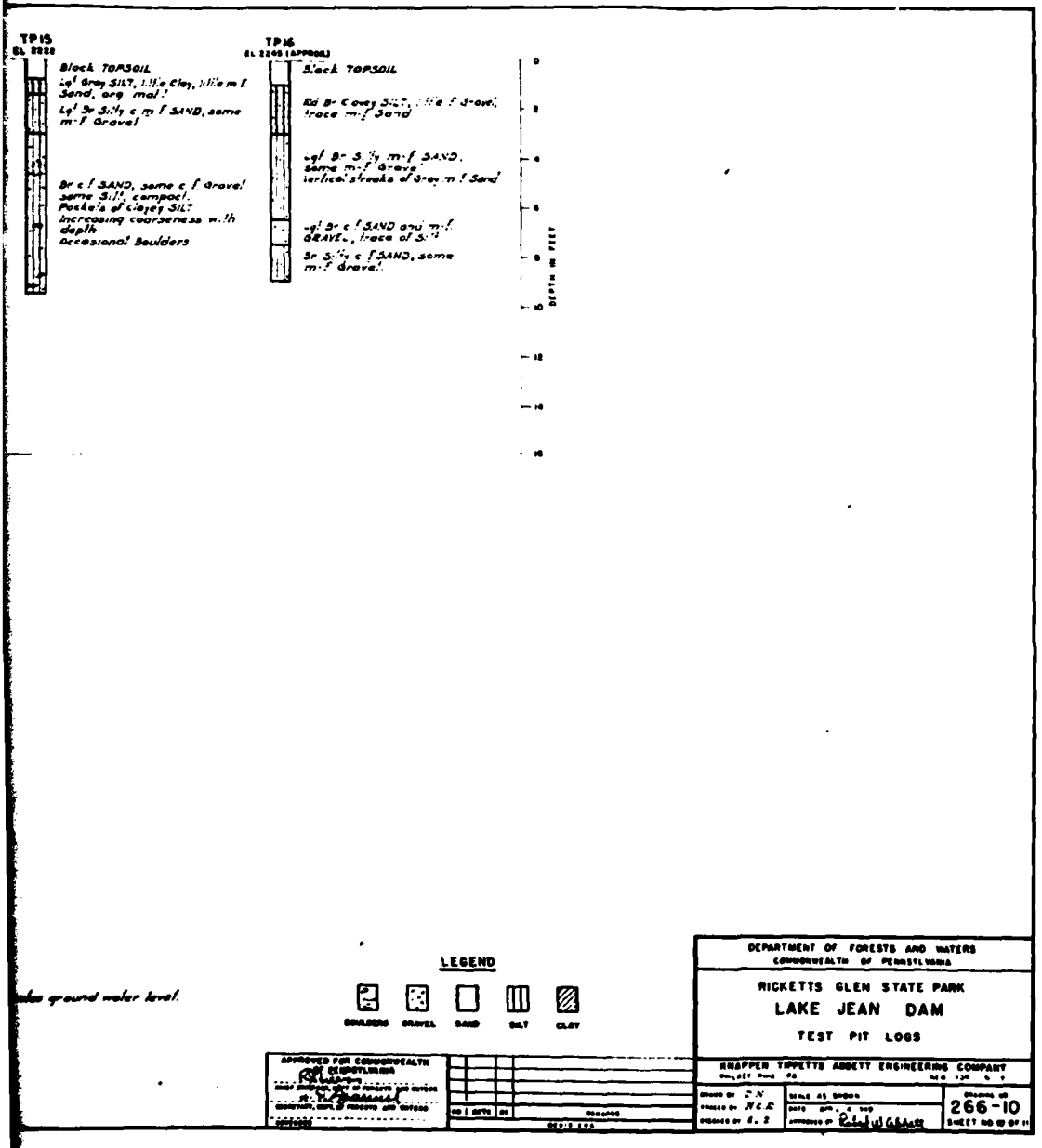


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FIGURE 11

APPENDIX F

GEOLOGY

Geology.

Lake Jean Dam is located in Luzerne County, in the Allegheny High Plateaus section of the Appalachian Plateaus Province, north of the Allegheny Front. In this area the rock strata is nearly horizontal in most places, except for a few minor folds. The geomorphic evidence suggests the region has been base leveled or reduced to a well defined peneplain, and then elevated.

Glacial drift of at least three Pleistocene glacial stages is found in this area, the last being the Wisconsin. Striae left on bedrock by advancing ice sheets, suggest that the general direction of ice movement was about S30°W.

From the geologic profile and boring logs made by Knappan, Tippetts, Abbett Engineering Company, at the time of construction, the following information reveals, in part, the subsurface conditions along the centerline of the dam. Glacially derived soils, somewhat lenticular in nature, and consisting of silty sands and sandy silts, gravel and boulders, range in thickness from approximately two to 35 feet, thickening from west to east. Bedrock underlying these soils is predominately a hard, gray, fine to coarse grained quartzitic sandstone, uniformly bedded, with thin discolored joints. Lesser amounts of hard, light gray quartzitic, gravelly conglomerate and conglomeratic sandstone occur. Thin seams of soft to medium hard, gray to reddish shale occur infrequently.

It appears that the contact between the Mauch Chunk Formation of Upper Mississippian age and the Pocono Formation of Lower Mississippian age, occurs approximately 40 feet below the top of the dam. The Pocono sandstone disconformably underlies the Mauch Chunk shale, it consists principally of hard massive gray sandstone and conglomerate, with generally thin and localized coal beds.

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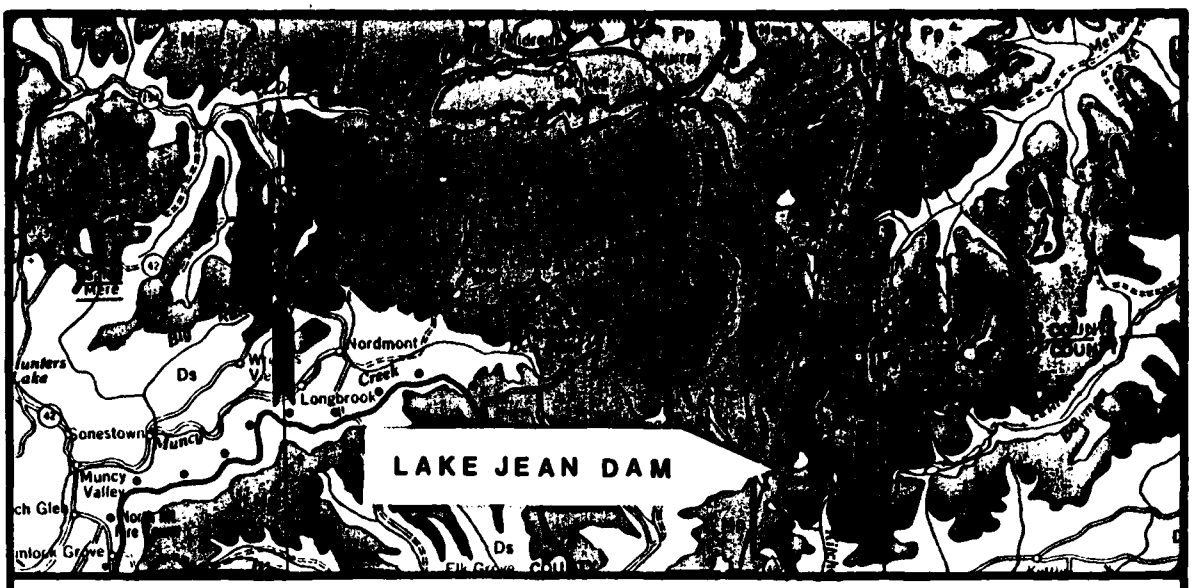
[1]Lohman, S. W., Ground Water in Northeastern Pennsylvania, Pennsylvania Geological Survey, Fourth Series, Bulletin WA, 1937.

[2]Newport, T. G., Summary Ground Water Resources of Luzerne County, Pennsylvania, Pennsylvania Geological Survey, Fourth Series, Water Resource Report 40, 1977.



LEGEND

PENNSYLVANIAN

Pp — **Pottsville Group**

Light gray to white, coarse grained sandstones and conglomerates with some mineable coal; includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mmc — **Mauch Chunk Formation**

Red shales with brown to greenish gray flaggy sandstones; includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties; Loyalhanna Limestone at the base in southwestern Pennsylvania.

Mp — **Pocono Group**

Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale; includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations; includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties

DEVONIAN

Ds — **Susquehanna Group**

barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports; barbs on "Chemung" side of line.

Border of Illinoian drift

Border of Wisconsin drift

Note: The bedrock surface is covered with Pleistocene age Wisconsin and Illinoian till composed of sands, gravels and silty clays of variable thicknesses.

Scale

0 2 4 6 8 10 MILES

REFERENCE:
GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNSYLVANIA, DEPT. OF INTERNAL AFFAIRS, 1950, 1:500,000

GEOLOGY MAP

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